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ABSTRACT

This document presents information about aspects of the lead pollution problem that relate to children, suggests a community action program for controlling lead hazards, estimates the staff and other costs involved in developing such a program, and tells how to synthesize the program components for maximum effectiveness. The seven parts of the document concern themselves with various aspects of the problem: (1) epidemiology, etiology, clinical signs and symptoms of lead poisoning; (2) planning a city program for lead control; (3) community awareness and education; (4) casefinding to identify children with increased lead intake; (5) guidelines for development and enactment of lead control legislation; (6) financing a lead-control program; and (7) identification and management of environmental lead sources in the residential neighborhood. Appendix I gives an alternate approach to aspect (7). Appendix II contains work sheets for environmental evaluation from United States census data, and census tracts. (Author/NH)

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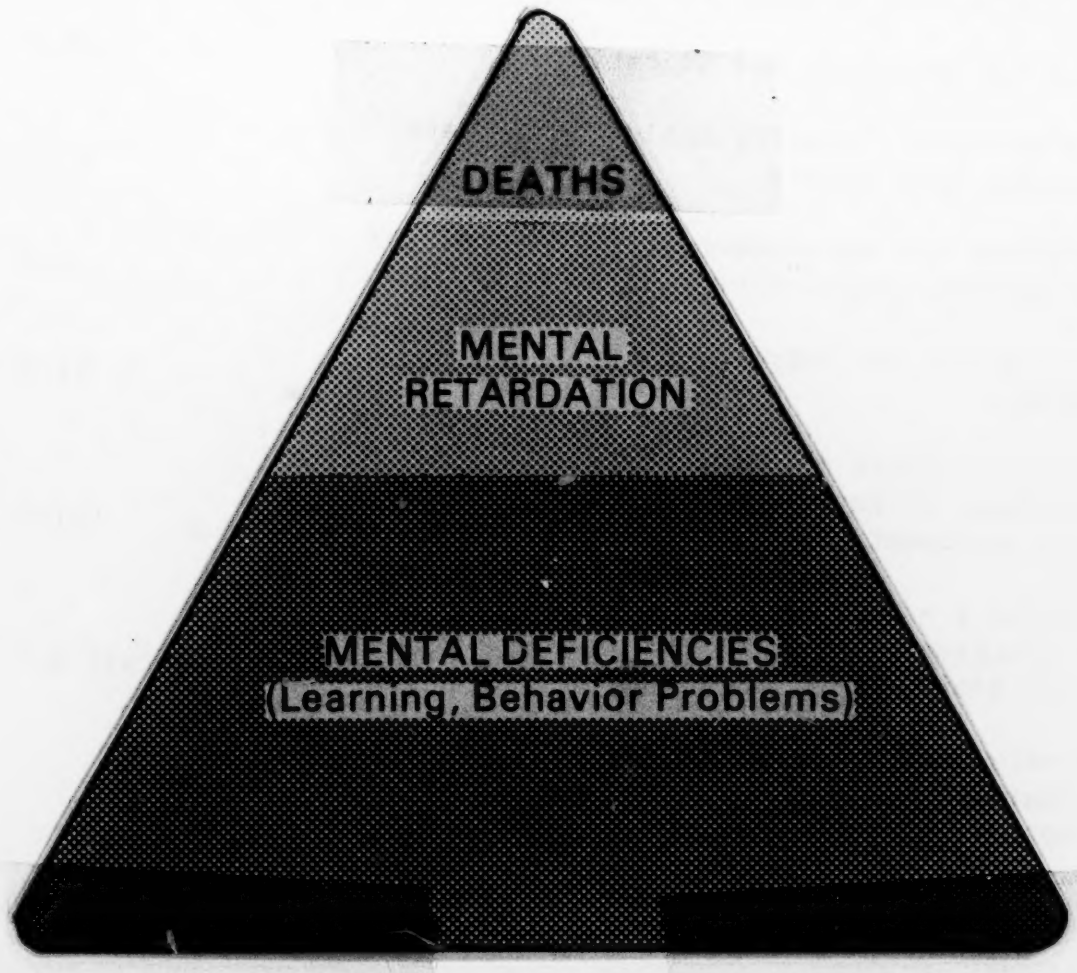
CONTROL OF LEAD POISONING IN CHILDREN



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FOREWORD

A number of communities are presently considering the development of programs to control lead hazards to children. The Public Health Service has prepared guidelines to facilitate planning that are intended to provide essential background material for communities wishing to develop and carry out a lead control program.

The PHS is concerned about the lead problem in this country and plans to provide consultative assistance to cities and communities combating this environmental pollutant and is exploring the possible development of better ways to identify and treat the problems related to lead.

The purpose of this document is to make available the information on those aspects of the lead problem that relate to children, to present suggested methodologies for developing the various components of a community action program for controlling these lead hazards, to estimate the staff and other costs involved in developing each component of this total program, and to synthesize the components of the program in a manner that will allow a systematic and coordinated program to emerge.

This document is divided into seven parts. Part I reviews the lead problem as it relates to children; it lists clinical signs and symptoms; presents the problem statement and includes brief discussions of the epidemiology and the etiology, the need for standard definitions and references to look for blood lead measurements.

In Part 2, the philosophical and practical considerations necessary for a city planning a total lead-control program are delineated.

In Part 3, methodologies are presented that will serve to help a community to develop a level of awareness concerning the problem of lead necessary for the successful implementation of a total program. In this section, both educational and organizational methodologies are developed.

Part 4 is devoted to several alternative systematic methodologies for the identification and disposition of children with increased body burdens of lead.

Part 5 is concerned with legislation. It lists hazards to be considered in legislation and in enforcement of Federal, State, and local laws and ordinances that exist or are being developed. It presents an example of a model ordinance that a city may use as a guide in developing its legislation.

Part 6 covers various types of fiscal support for a community program for the control of lead. Here are identified those Federal potential resources and revenues that could be used to carry out a total or partial lead program.

In Part 7, the tools and methods for identifying lead sources within the total environment are presented, as well as present methodologies available for deleading the environment. The discussion suggests procedures whereby a city may develop a systematic approach to the analysis of this specific aspect of the program.

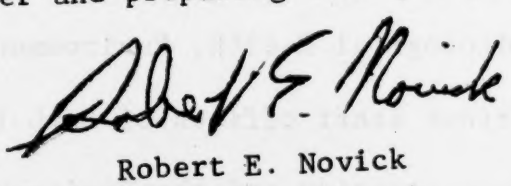
Application and testing of the guidelines within a single community can be expected to stimulate widespread interest among a large number of municipalities, especially where there are inner city areas with badly deteriorated dwellings. Interested groups should stimulate action and early planning to obtain resources from their State Legislatures and city government to assist in supporting the control programs.

Educational programs and activities undertaken through liaison with government agencies and industry can be expected to reduce some sources of hazard. Increasing awareness by physicians can be expected to result in earlier identification and disposition of cases of children with lead poisoning and high lead intake.

The costs of detection and measurement of lead in biologic and other materials will be reduced by work stimulated by increasing interest in this health problem. The same will apply for deleading techniques.

The planned program is directed toward elimination of hazardous sources and is intended to afford continuing, adequate protection of children against adverse effects of lead on physical and mental health.

I wish to acknowledge with gratitude the fine work of the Bureau of Community Environmental Management staff members -- Fred Burg, M.D.; Barry King, Ph.D.; Frank Jacocks; Floyd Oglesbay; Charles Petrillo; Lewis Polk; A.F. Schaplowsky; James Simpson; Roger S. Challop, M.D.; Edward B. McCabe, M.D., and Robert Swiecicki. Major credit is due them for putting this program together and preparing this pre-publication draft.



Robert E. Novick
Director
Bureau of Community
Environmental Management

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The Bureau of Community Environmental Management received encouragement and counsel from many individuals and organizations in the preparation of these guidelines. Appreciation is particularly expressed for the valuable assistance provided by the agencies which participated in the HEW intradepartmental meetings on "Lead Poisoning in Children" and to those local communities interested in the problem or conducting control programs.

Notable contributions were made by the following agencies and their personnel:

1. Center for Community Planning, Office of the Assistant Secretary for Planning and Evaluation, and Office of Child Development, Office of the Secretary.
2. The New York City, Baltimore, Philadelphia, Chicago, Boston, Washington, D.C., Pittsburgh, and Cleveland Health Departments.
3. Maternal and Child Health Service and Community Health Service, Health Services and Mental Health Administration.
4. Office of Product Safety, Food and Drug Administration.
5. National Institutes of Health.
6. Social and Rehabilitation Service.
7. Bureau of Occupational Safety and Health and Bureau of Radiological Health, Environmental Health Service.
8. Various staff offices of both the Environmental Control Administration and the Environmental Health Service.

MEDICAL ASPECTS OF CHILDHOOD LEAD POISONING

Policy Statement
by
Jesse L. Steinfeld, M.D., Surgeon General
U. S. Public Health Service

The U.S. Public Health Service recommends that screening programs for the prevention and treatment of lead poisoning (plumbism) in children include all those who are 1 to 6 years of age and living in old, poorly maintained houses. Children exposed to other special local conditions involving lead hazards also should be screened.

Lead-based paint was commonly used for interior purposes until the 1940's when it was largely replaced by titanium-based paint; therefore, children living in dilapidated or obviously deteriorating houses built prior to that time are to be given particular attention. Children who frequently visit such neighborhoods--homes of baby sitters, relatives, and playmates--also should be included in screening programs. Today lead-based paint is still used to some extent for the exteriors of dwellings, and this potential source of exposure to lead should not be overlooked. Children at risk should be screened periodically during the years 1 to 6, and longer if indicated.

The prime goal of screening programs is the prevention of lead poisoning. The prevention of plumbism can be achieved through the early detection of children with undue absorption of lead, followed

immediately by remedial action before the state of overt poisoning is reached. Consequently, screening programs should not be limited to the detection and treatment of children with lead poisoning. To be effective, such programs must also include adequate plans for medical follow-up of those children screened and found to have high levels of lead absorption, as well as those diagnosed as having lead poisoning. For all of these children, the program must provide for adequate and speedy removal of lead hazards from their homes.

In children, the determination of blood lead, even with its pitfalls, is generally considered the most reliable of the many biological tests or indices of lead exposure and absorption. The U.S. Public Health Service, therefore, recommends that blood lead determinations be used in screening children for the detection of lead poisoning and excessive absorption of lead.

Various studies have reported that the median concentration of blood lead in both adults and children in the urban population--without undue exposure to lead--ranges from 16 to 27 micrograms per 100 milliliters of whole blood. The normal range of blood lead is stated to be 15 to 40 micrograms per 100 milliliters of whole blood.

Until future studies indicate otherwise, it is recommended that a blood lead concentration of 40 micrograms or more per 100 milliliters of whole blood (as validated by the dithizone technique), determined on two separate occasions, be considered evidence suggestive of undue absorption of lead, either past or present. It is essential that the

current degree of exposure be determined in children who present such evidence. Since 90 percent or more of the measured lead in blood is attached to the red blood cells, seemingly low blood levels in children with anemia may be misleading.

In some cities, undue exposure to and absorption of lead among children may be so prevalent that an overwhelming number of those screened are found to have blood lead values of 40 micrograms or more per 100 milliliters of whole blood. Under such circumstances, local resources may not permit immediate evaluation of all such children, and a schedule of priorities will have to be adopted. Programs with inadequate facilities or inadequate financial support may, in their initial phase of operation, give priority to children with blood lead values of 50 micrograms or more per 100 milliliters of whole blood. Among children with blood lead values of 40 to 49 micrograms per 100 milliliters of whole blood, the 1- to 3-year-olds should be given priority. This age group comprises approximately 85 percent of the reported cases of plumbism, and it also has the highest mortality rate from this disease.

This schedule of priorities is permissible only in the initial phase of operation of programs with limited resources. All programs that adopt such a schedule should plan to expand their operation systematically so that 2 years after the programs have come into existence all children with undue absorption of lead or with lead poisoning will be given adequate care.

CHILDREN WITH BLOOD LEAD VALUES OF 80 MICROGRAMS OR MORE PER 100 MILLILITERS OF WHOLE BLOOD

The U.S. Public Health Service recommends that all children found to have a blood lead concentration of 80 micrograms or more per 100 milliliters of whole blood, regardless of the presence or absence of clinical symptoms or of other laboratory findings, be considered as unequivocal cases of lead poisoning and that they be handled as medical emergencies. They should be hospitalized immediately for chelation therapy. This emphatic recommendation is made because the risk of acute lead encephalopathy in this group is great, the onset of the disease is unpredictable, and its course is fulminant. If encephalopathy develops, at least 40 percent of these children will sustain severe and permanent brain damage. Treatment prior to the onset of encephalopathy may improve this grim prognosis.

CHILDREN WITH BLOOD LEAD VALUES OF 50 TO 79 MICROGRAMS PER 100 MILLILITERS OF WHOLE BLOOD

All children who in screening programs are found to have blood lead values of 50 to 79 micrograms per 100 milliliters of whole blood should be referred immediately for evaluation as possible cases of lead poisoning. Physicians in charge of such evaluation have the responsibility for making a diagnosis of lead poisoning in these children. Symptoms of lead poisoning--such as abdominal pain, anorexia, constipation, and those of central-nervous-system (CNS)

origin--are frequently absent in this group of patients. If any of these symptoms are present and cannot be explained otherwise, the diagnosis of lead poisoning should be considered.

In the absence of clinical symptoms, the following tests are helpful in suggesting a diagnosis of lead poisoning. The U.S. Public Health Service recommends that those whose blood lead values are in the range of 50 to 79 micrograms per 100 milliliters of whole blood on two successive tests be considered suggestive cases of lead poisoning if they have any of the following conditions:

1. Urinary excretion in 24 hours of more than 1.0 micrograms of lead per milligram of Ca-EDTA administered intramuscularly at a dose of 50 milligrams per kilogram of body weight--the total dose not to exceed 1 gram of Ca-EDTA;
2. Serum delta-aminolevulinic acid (ALA) level of greater than 20 micrograms per 100 milliliters of whole blood using the Haeger-Aronson method;
3. Urinary output of coproporphyrin greater than 150 micrograms per 24 hours;
4. Urinary output of delta-aminolevulinic acid greater than 5 milligrams per 24 hours;
5. The presence of basophilic stippling of red blood cells, "lead lines" in long bone x-rays, or a strongly positive urine spot test for coproporphyrin may be considered indicative

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of lead poisoning when laboratory facilities for making the tests designated above are not available.

It is emphasized that while only positive findings are significant, negative findings do not rule out the possibility of lead poisoning. Knowledge and technology related to lead and its effects on human beings is rapidly advancing and the future is sure to hold more accurate and simpler biological indices of increased lead exposure and toxicity. The U.S. Public Health Service stands ready to modify the above recommendations when future research so indicates.

Children whose blood lead values fall in the range of 50 to 79 micrograms per 100 milliliters of whole blood and who are not diagnosed as suffering from lead poisoning should be closely followed and supervised. Determination of blood lead values at monthly intervals at the very least is recommended, particularly in the summer. Sources of hazardous lead exposure should be identified and promptly brought to the attention of the appropriate local government agency for corrective action.

CHILDREN WITH BLOOD LEAD VALUES OF 40 TO 49 MICROGRAMS PER 100 MILLILITERS OF WHOLE BLOOD

Where resources permit, all children who in screening programs are found to have blood lead values of 40 to 49 micrograms per 100 milliliters of whole blood should be recalled immediately for evaluation. This evaluation should include another determination of

blood lead and inquiry concerning pica and the child's current exposure to lead in his home and in the homes that he frequently visits. Exposure may be significant even in the absence of a hisotry of pica since parents may be unaware of such ingestion, or unwilling to admit it. X-ray of the abdomen is useful in confirming current or recent ingestion of lead.

Children whose blood lead values in repeated tests fall in the range of 40 to 49 micrograms per 100 milliliters of whole blood, and who--according to the evidence of their histories--are no longer exposed to lead hazards, do not need to be followed for continued evaluation. For example, those who live in new housing projects, and who do not frequently visit homes with lead hazards, are presumed to be no longer exposed.

Those who continue to be exposed to lead hazards in their homes, or elsewhere, should be closely followed, with determination of the level of blood lead at least every 6 to 8 weeks. Closer supervision in the summer months is advisable, particularly among children under 3 years of age. Where possible, determination of blood lead should be made at 4-week intervals in the summer. Dwellings identified in screening programs as potential sources of lead hazards should be brought promptly to the attention of the local government agency responsible for enforcing housing codes and regulations so that proper corrective action may be taken.

TREATMENT AND FOLLOW-UP OF CHILDREN WITH LEAD POISONING

All children who are diagnosed as having lead poisoning should be:

1. Treated immediately;
2. Removed from the source of lead exposure at home or in any other environment--until proper corrective action has been taken to eliminate the hazards;
3. Carefully followed until 6 years of age or longer, if indicated, in order to prevent repeated lead exposure and poisoning;
4. Given adequate neurological and psychological assessment at the time of diagnosis and in ensuing years to detect at an early stage any neurological or behavioral deviation, including minimal brain damage, so that proper therapy and school placement can be instituted; and
5. Given additional clinical and laboratory evaluation, when indicated, to assess other sequelae of lead poisoning, such as renal, myocardial, and metabolic disorders.

The treatment and follow-up recommended can best be accomplished through development of centers designed specifically for the treatment and evaluation of children with lead poisoning, and integrated into planned or existing community facilities for comprehensive care. Careful medical follow-up throughout the preschool years is necessary because of the ubiquity of lead paint in old, deteriorating housing and the persistence of pica in many young children once the habit has been established.

REMOVAL OF LEAD HAZARDS FROM THE CHILDREN'S ENVIRONMENT

Sources of lead must be removed from the environment of children who have lead poisoning or who have absorbed hazardous amounts of the poison into their blood. Immediate follow-up of these children should be initiated with the appropriate local government agencies--with reports on their dwelling units and on other suspect environments or sources of lead hazards--so that proper corrective action may be taken. In fact, effective medical care of children with plumbism is almost totally dependent upon prompt and thorough environmental hygiene to prevent a continuing buildup of lead in their bodies.

REPORTING LEAD POISONING AND LEAD ABSORPTION

1. Lead poisoning should be considered a disease that must be immediately reported to the local health department, when suspected or discovered.

2. All laboratories performing blood lead determinations should be required to report to the local health department the results of tests of blood samples having 40 micrograms or more per 100 milliliters of whole blood.

3. A uniform reporting form should be used to record information collected in screening programs in order to provide comparable data and meaningful statistics on the problem of excessive lead absorption and lead poisoning in children.

Dr. Steinfeld has designated the Bureau of Community Environmental Management, within the Department of Health, Education, and Welfare, as the activity that will assist cities and towns in the establishment or improvement of programs to control lead paint poisoning.

PART I

LEAD AS A PROBLEM RELATED TO CHILDREN

HEALTH HAZARD

Lead poisoning is a serious, sometimes fatal, illness of known cause; it is readily diagnosed and treated, and completely preventable in most cases.[1] It has been repeatedly emphasized by Lin-Fu that its etiology, pathogenesis, pathophysiology and epidemiology are known and that practical methods of control are available. Yet, each year, childhood lead poisoning continues in epidemic proportions in many of our cities.[2]

Exposure of children to sources of lead intake may result in clinically identifiable conditions and/or subclinical adverse biologic effects.

The consequences of lead poisoning in children include: death; an involvement of the central nervous system--termed acute encephalopathy--and atrophy of the optic nerve; neuromuscular effects; interference with the development of red blood cells; and an abdominal syndrome characterized by colic, anorexia and malaise.[2,3,4,5,6] Conditions may include impairment in learning and mental retardation.[7,8] Since lead can pass from the maternal blood to the fetal blood, it can destroy a fetus during pregnancy.[9]

Lead levels associated both with clinical and with subclinical conditions interfere with the formation of red blood cells. Effects of lead may be extremely subtle. Highly sensitive tests

have shown that very minute quantities, well below those resulting in illness, do have a measurable effect on enzyme systems.[10] It also interferes with normal activity within the body cells and has an injurious effect on germ cells.

THE PROBLEM

The overall problem is the protection of children from lead poisoning and from the other adverse effects of lead intake. The two principal aspects are prevention and therapy. These guidelines on control of lead hazards among children are concerned with prevention. Thus, the specific problem--the problem immediately at hand--is the elimination of sources of lead hazardous to children.

Some sources of lead exposure are common to both children and adults. There are, however, some unique aspects of the problem of prevention among children. Some children deliberately eat materials--rubbish--that may contain lead.

The principal, and by far the most important, vector of the disease is lead-based paint. Paint with a high lead content was used extensively in the interiors of dwellings built prior to World War II.* Multiple layers of the old, high-lead-content paint flake and chip because of poor maintenance of the now deteriorated dwellings housing disadvantaged children. This and other lead materials are ingested by children, usually as the result of pica.

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* The American National Standards Institute (formerly the American Standards Association) established a standard in 1955 limiting lead content of interior paint to 1 percent.

The families particularly affected by lead hazards are those Blacks and Spanish Americans who, because of their economic status, live in old residences, usually in the inner city, where housing conditions have seriously deteriorated.

Pica. This is an exaggerated manifestation of oral behavior continuing into the 12- to 36-months age group. Those with pica exhibit a habitual, purposeful, and compulsive search for and ingestion of unnatural, non-food substances. This behavior may persist up to 5 years of age. It occurs in both males and females.

A theory that nutritional deficiency is etiologically related to pica was proposed but could not be demonstrated in a study of urban children in Washington, D.C.[11] It was noted in this study that Black families who had recently moved to Washington from the South seemed to be afflicted most frequently. This was explained as a reaction to the economic and social stress of new surroundings. Lead poisoning should be specifically looked for whenever a history of pica is noted. Bradley et al[12] stated that approximately 70 percent of the children with high levels of blood lead had a history of pica. The authors considered this to be underreporting, possibly resulting from parents' failure to observe such behavior, or reluctance to admit its occurrence. Chisolm and Kaplan[6] stated that the relationship of mother and child "is often a critical determinant of pica." Approximately 50 percent of the mothers of these children with pica also exhibited the habit. The child may use pica as a

method of relieving anxieties or tensions brought on by an absent or ineffective mother, e.g., a working mother or one who has emotional difficulties and is unable to cope with family responsibilities. It also may be a means by which the child seeks to gain attention. Incidence of pica is especially prevalent in lower socioeconomic groups. It may be associated with certain cultures.[6] However, 80 to 85 percent of children of all socioeconomic groups may manifest oral exploration between 1 and 3 years of age.

EPIDEMIOLOGY

ENDEMIC AND EPIDEMIC LEAD HAZARDS

The sources of lead exposure for children may be continuing or endemic; they also may be sporadic or epidemic. In addition to paint, other rubbish such as caulking, plaster, putty, comic books and newsprint, food, water, food containers, and particles from automotive and industrial emissions constitute potentially hazardous sources.[4,6,13,14,15] While atmospheric contaminants and materials other than paint may not be unique in the causation of ill effects from lead intake, they can be considered contributory to blood lead of adults as well as of children.

Airborne lead-containing particles in excess of 5 microns settle out and contribute to contamination, especially within the central city, and are likely to be ingested by children and adults. Smaller particles may be inhaled. Of these, the larger particles are returned to the mouth and may be swallowed. Those less than

one micron may reach the alveoli of the lungs.[5,16,17] Twenty-five to 50 percent of the amount of these inhaled particles may be absorbed directly into the systemic blood vessels.

Food also is an endemic source of lead intake. About 90 percent of the lead ingested passes through the digestive tract without being absorbed and is excreted in the feces. The remainder is absorbed into the portal circulation. Some of this is secreted into the bile, is returned to the alimentary tract and added to the 90 percent excreted in the feces. Goldsmith and Hexter stated that the total quantity of lead absorbed from the respiratory tract is of the same order of magnitude as that absorbed from the gastrointestinal tract--and that further increases in atmospheric lead will result in higher blood lead levels.[14] Pottery and cooking utensils containing leachable or extractable lead may constitute an endemic source in some homes.[18]

Burning of lead batteries and lead impregnated materials, or ingestion of their ashes, may result in epidemics of lead intoxication. Emissions of smoke and effluents from burning industrial plants manufacturing batteries and those manufacturing paints have caused incidents in which lead intoxication occurred in many of the neighboring residents and in others exposed.

DEVELOPMENT OF LEAD POISONING

Lead is not an essential or physiologic constituent of body fluids or other tissues. It is, however, found in the blood of

both children and adults who have not experienced industrial or other known unusual exposures to lead. An average value for lead intake in the adult is considered as approximately 0.33 mg Pb/day; this includes the amount of lead ingested and the amount inhaled.[19] Kehoe states that approximately 10 percent of the lead ingested is absorbed by the gastrointestinal tract, and about 50 percent of inhaled lead may be absorbed. He found that if a human subject was fed an additional 0.3 mg of lead per day, the intake exceeded the output. While there was a slightly increasing accumulation in the body, there was no increase in the concentration of lead in the blood during the 60 weeks the experiment continued.

Chisolm has reported that "normal" exposure of both adults and children is associated with blood lead concentrations of 15 to 40 μg/100 ml of blood.[6] A "normal" median level for lead in children is 27 μg/100 ml blood.[15] A recent, unpublished study by Haggerty and Norland reported blood lead levels of small groups of urban children and of country children.[20] The mean value for the former population was 25 μg percent and for the latter, 13 μg percent. Only one of the 19 rural children had a blood level above 20 μg percent, whereas there were 19 of the 30 urban children above this level.

Chisolm and Harrison determined the amount of lead excreted in the feces in six nonexposed children of physicians at home. The mean was 0.132 mg Pb/24 hours, and the range was 0.120 to 0.175 mg/24 hours.[3] Chisolm and Kaplan state that "as the mean daily

lead ingestion increases beyond 0.5 mg Pb, the entire load cannot be excreted so that the accumulation of an excessive body-lead burden begins and will increase progressively as long as abnormal ingestion continues." Fecal excretion was also measured in a group of "exposed-normal" children with a history of ingestion of foreign materials, presumably containing lead, and living in dwellings containing hazardous sources of lead. The mean fecal excretion for this group was 0.832 mg Pb/24 hours, and the range was 0.087 to 1.93 mg/24 hours. These children had blood lead concentrations of less than 60 μg/100 ml; they showed no symptoms attributable to lead intoxication. A group showing elevated concentrations of blood lead and roentgenographic evidence of lead lines in the bones--but no symptoms attributable to lead intoxication--had a mean fecal lead excretion of 2.16 mg/24 hours, with a range 0.116 to 9.60 mg per 24 hours. Six children with various degrees of lead poisoning showed a mean value of 44 mg/24 hour stools, with a range of 5.04 - 104.0 mg/24 hours.[3] If we assume that 90 percent of the lead ingested was excreted, the mean amount of lead in paint chips taken in by the children with lead poisoning could not have been less than about 50 mg. Ingestion of a few small paint chips may contain 50 mg or more and "constitutes a truly massive exposure."[6]

The symptoms of chronic lead poisoning depend upon the rate of absorption from the intestines, and from lead deposits in the bone, with transfer to the blood or soft tissues.[21] It has been

hypothesized--on the basis of the tests conducted on the fecal excretion of children in Baltimore--that a minimum exposure period of about 3 months is required for the production of symptoms of lead poisoning. In exposures of greater duration, the advent of summer becomes the controlling factor; this relationship between the seasonal factor and the presumed duration of exposure has been demonstrated by Chisolm.[3]

The incidence of lead poisoning increases during the warm summer months--May through September.[22] Jacobziner[23] noted that 45 percent of the cases reported in New York City during 1954 to 1963 occurred during the months of June through September. Chisolm reported that over 80 percent of the 105 cases occurred during these months.[3] Physiological and environmental factors have been associated with the seasonal increase. Increased vitamin D production during the summer months--due to more sunlight--influences mineral metabolism. Christian stated that summer heat may lead to dehydration, acidosis, and increased absorption of lead.[24] Furthermore, during the summer, children are almost constantly out-of-doors, where they may come in contact with lead-based paint that is used on building exteriors.

The majority of cases of childhood lead poisonings occur to those between the ages of 12 to 36 months. Because of the extreme vulnerability of the central nervous system of infants and children, a relatively short period of exposure may be followed by severe symptoms of acute encephalitis. Encephalopathy may occur even before

anemia, severe abdominal colic, or other symptoms have developed.[21] The vagueness of the initial signs and symptoms contribute to the failure to diagnose cases of lead intoxication. Further, it should be emphasized that, even in the light of the present advanced state of medical knowledge, there is a low index of suspicion on the part of some physicians because of their belief that lead poisoning no longer occurs.

MAGNITUDE AND EXTENT

Municipalities that have conducted lead-screening studies have found elevated levels of lead in from 5 to 10 percent of the children tested. Many communities, however, have not carried out lead surveys, and there are few data to indicate the probable extent of the lead problem in these areas. Where screening studies have been conducted, measurements have been made on selected populations rather than on the general population. Increasing awareness of the existence and dangers of lead poisoning is usually accompanied by a marked increase in the number of cases that are detected within a community. The duration of screening or control programs may also influence the real or apparent incidence of childhood poisoning. Control programs that have been maintained for several years may result in a reduction in incidence of the condition.[25,26] Other screening programs have been discontinued when the number of cases decreased; it is not known whether the lower incidence persisted in subsequent years. In consequence, it is not possible to substantiate estimates of the numbers of children in the United States who have clinical lead poisoning or

subclinical conditions having adverse effects on their physical and mental health. There are, however, sufficient data to establish unequivocally that lead poisoning and undue lead absorption among children is an important problem, and that it is widespread .

Reports published by cities and counties--and direct personal communications from physicians--provide information, although incomplete, on the location of childhood cases throughout the United States (Figure 1). At least one case has been reported in each of 26 States and in the District of Columbia--as shown on the map--and in the cities or counties listed. It is not known whether any cases of lead poisoning have occurred in the remaining States. Even so, the survey provides evidence of the widespread distribution of this condition in children.

Relatively few communities report the incidence of lead poisoning and undue absorption of lead. Furthermore, considerable variation exists with respect to the nature and scope of information presented by those that do publish reports or notes. In view of the lack of more substantial data, those working toward control and elimination of childhood lead poisoning are constrained to base their estimates of incidence on the results of major screening programs in a few metropolitan communities and on census data relevant to hazardous urban environments. A few examples of significant screening programs are presented below.

Cities and Counties Known to Have Had One or More
Cases of Childhood Lead Poisoning, All Sources
(Based upon information as of Dec 1, 1970)

* San Francisco, Calif
Denver, Colo.
* New Haven, Conn.
Hartford, Conn.
Waterbury, Conn.
Bridgeport, Conn.
* Washington, D.C.
* Chicago, Ill.
* New Orleans, La.
* Boston, Mass.
Portland, Me.
Baltimore, Md.
* Detroit, Mich.
Minneapolis, Minn.
* St. Louis, Mo.
* Kansas City, Mo.
* Newark, N.J.
Nassau County, N.Y.
* New York, N.Y.
Rochester, N.Y.
Cincinnati, Ohio
Cleveland, Ohio
Columbus, Ohio
* Philadelphia, Pa.
Pittsburgh, Pa.
Dallas, Texas
* Norfolk, Va.
Milwaukee, Wisc.

* Cities having child lead-screening programs.

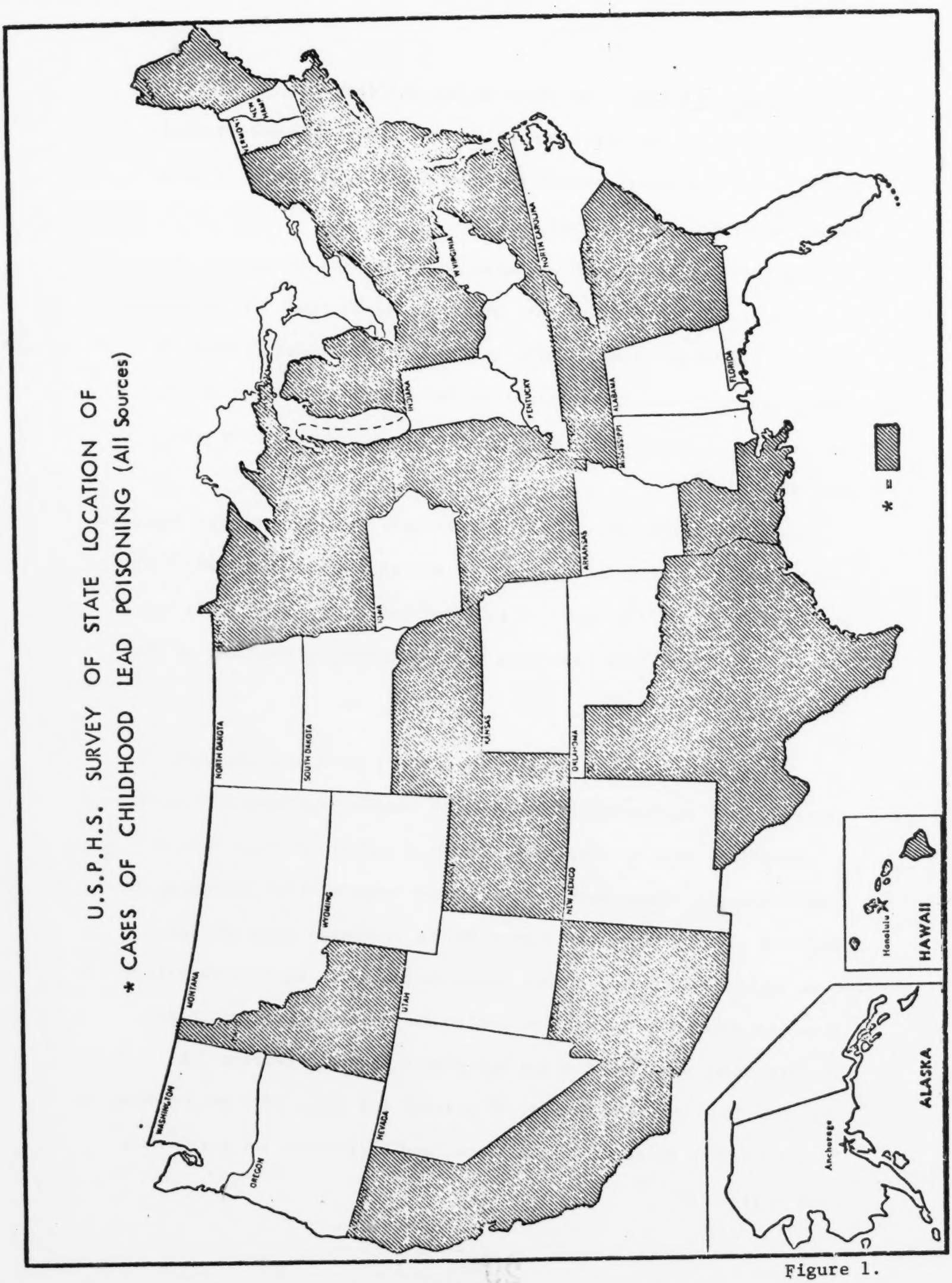
U.S.P.H.S. SURVEY OF STATE LOCATION OF
* CASES OF CHILDHOOD LEAD POISONING (All Sources)
* =
WASHINGTON
OREGON
NEVADA
MONTANA
WYOMING
UTAH
NORTH DAKOTA
SOUTH DAKOTA
NEW MEXICO
TEXAS
OKLAHOMA
ARKANSAS
MISSOURI
IOWA
MINNESOTA
WISCONSIN
ILLINOIS
MICHIGAN
INDIANA
KENTUCKY
TENNESSEE
MISSISSIPPI
ALABAMA
GEORGIA
FLORIDA
SOUTH CAROLINA
NORTH CAROLINA
VIRGINIA
WEST VIRGINIA
PENNSYLVANIA
NEW YORK
MAINE
Honolulu
HAWAII
Anchorage
ALASKA

Figure 1.

Chicago, Illinois. In 1967, 28,000 children under 5 years of age (one-fifth of the total number in that age group) were tested--2,379, or 8.5 percent, showed elevated blood lead levels of 50 μg Pb/100 ml of blood, or higher.

In 1968, of the 40,800 children under 5 years of age who where screened, 1,556, or 3.8 percent, had lead levels equal to, or greater than, 50 μg/100 ml blood. While the number of children tested in 1968 in each of the nine urban areas was significantly increased, the percent of those with excessive blood lead decreased by more than one-half.[26]

In 1969, 48,000 children were screened. In spite of the vigorous activities being directed against the disease, there were 456 cases of lead poisoning, 716 cases of elevated levels of blood lead, and one death. The percent incidence was approximately the same as for 1968, i.e., 4.1 percent.

Philadelphia, Pennsylvania. In January 1970, Philadelphia reported that approximately 8,700 blood samples had been submitted by physicians from 33 hospitals, and by a number of local medical practitioners. There were 777 confirmed cases of lead poisoning of children ranging from less than 6 months to over 5 years of age. Case fatality rates per 10,000 children from zero to 5 years varied from the maximum of 6.2 in one health district to zero in others. The frequency distribution for age groups showed 3 percent for children less than 1 year old, 47 percent for those of 1 to 2 years, 33 percent for those of 2 to 3 years, and 17 percent for those more than 4 years old.[27]

New Haven, Connecticut. An intensive casefinding program in 1969 identified 151 cases with levels of blood lead greater than 50 μg/100 ml and 43 cases with greater than 70 μg/100 ml. There were 28 admissions to hospitals for 24 children; seven had clinical lead intoxication; one child showed encephalopathy.

Baltimore, Maryland. In 1931 the Baltimore Health Department recognized the hazard to children of lead-based paint. Between the years 1931 to 1966, there were a total of 1,096 cases, including 135 deaths. In 1967, there were 55 cases of lead poisoning, 15 identified by clinical diagnosis and 40 by levels of blood lead in excess of 60 μg/100 ml blood. In 1968, there were 43 cases, 13 clinically diagnosed and 20 with 60 μg/100 ml blood. In 1969, there were 52 cases, 19 clinically diagnosed and 33 with the high blood lead level.[25,29]

New York, New York. Of 61,167 poisonings reported to the New York City Poison Control Center between 1955 and 1963, 1,704 were cases of lead poisoning.[23] The most recent reports from New York City show that for the period of January to October 1970, approximately 55,000 of its children were tested.[30] Of these, about 1,700--3 percent--had levels of blood lead above 60 μg/100 ml and, in all, about 25,000--45 percent--had blood lead levels above 40 μg/100 ml. Approximately 600 of these children were hospitalized.

CASE HISTORIES

The meager data that are available for these relatively few cities cannot, of course, adequately reflect the seriousness of the lead hazard to children. Two cases that occurred in Hartford serve as examples of incidents that are recurring throughout the various areas in this country where a lead hazard exists.

A 2-year-old and a 3-year-old child from the same family showed high levels of blood lead: 130 μg/100 ml and 150 μg/100 ml, respectively. The 3-year-old showed clinical evidence of encephalopathy. Both children were severely ill for over 1 week. They were hospitalized for 1 month and were treated 5 days a week for 4 weeks. They were then discharged. A survey of their home showed that paint layers on the windowsill contained 50 percent lead. There were 14 members in the family living in four rooms. It was not possible to relocate the family, so the children had to be returned home. Three weeks later, the 3-year-old was readmitted to the hospital with lead poisoning. The cost for the initial hospitalization and treatment of the two children was $10,000; the effect of the lead poisoning on their brains is unknown.[16]

NATIONAL ESTIMATES

On the basis of data available, it has been estimated that each year there are 200 deaths from lead poisoning and approximately 400,000 children have elevated blood lead levels. The latter are potential cases of lead poisoning. It is estimated that 1 out of

25 cases is diagnosed and that 12,000 to 16,000, 3 to 4 percent, are treated. Fifty percent of the 400,000 cases constitutes a pool of potentially handicapped children. It is estimated that 6,000 to 8,000 children may be retarded as the result of excessive lead absorption.

The cost of support of a severely retarded child during his lifetime is approximately $250,000. The cost for hospital treatment of an uncomplicated case is approximately $1,000 to $2,000.

INSTRUMENTS AND METHODS

Measurement of lead levels in children is an effective method for the detection of sources of lead exposure and early recognition of cases requiring surveillance, therapy, or both. Blood lead determinations are the most reliable and widely accepted tests. The dithizone technique is the standard wet chemical analytic method.[31] It is commonly used in study and evaluation of other quantitative methods of lead measurement.

Rapid advances are being made in the adaptation of laboratory and industrial instruments to the quantitative measurement of blood lead, and lead in interior surface covering.* Methods of direct measurement of blood lead have recently been developed that require only a few drops of blood; these can be obtained by a finger prick. Earlier macroanalytic methods require 50 to 100 times as much blood, necessitating the drawing of blood samples from a vein.

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* Information on methods development as advances are made will be made available to communities upon request to Bureau of Community Environmental Management.

There are also indirect methods for assessing lead intake. These are used to measure biologic responses that accompany but do not measure increased blood lead levels directly. Methods that do not require venipuncture are highly desirable, both from the viewpoint of public (parent) acceptance and because of the level of technical competence required of those obtaining blood samples.

There are two general types of methods of measurement of lead in interior surface coverings. One is a destructive test involving chemical analysis of a paint chip or other sample from the surface covering. The other methods are nondestructive. These involve the use of radioisotope fluorescent techniques.

MICROMETHODS FOR BLOOD LEAD DETERMINATION

Atomic Absorption Spectrophotometry. In atomic absorption spectrophotometry the material to be analyzed is aspirated into a burner and burned in an open flame. For lead, the light from an emission source specific for lead--a lead hollow cathode lamp--is beamed through the flame. As the sample is burned, the lead absorbs some of the light from the lamp. This change is recorded as a sharp absorption peak. The amount of absorptance is in proportion to the concentration of lead in the sample. The atomic absorption spectrophotometers cost approximately $17,000 to $22,000. These instruments have been adapted for microdeterminations requiring as little as 20 to 40 µl of blood.

Anodic Stripping Voltammetry (ASV). This is an adaptation of polarographic techniques. Blood samples of 50 to 100 microliters are required. Following appropriate chemical digestion of the sample, the lead in the sample is electroplated on a specially designed graphite-mercury composite electrode. The composite electrode is set at a negative electrical potential with respect to a standard Ag/AgCl, calomel electrode. The lead as well as other trace metals--Zn, Cd, Cu, Bi, Tl--are deposited on the graphite-mercury electrode. After plating, the negative potential is reduced. The lead is returned to solution as the negative electrode potential is reduced, i.e., adjusted so that it is less negative with respect to the calomel electrode. The potential change results in stripping the graphite-mercury electrode of the several trace metals.

The current associated with the stripping of lead and other trace metals is recorded by separate peaks as they are returned to solution. The current is directly proportional to the quantity of lead stripped from the electrode. The ASV provides a nondestructive technique so that a sample may be used in repetitive measurements by the same laboratory or by different laboratories.

The anodic stripping voltammetry four-cell system (measuring four samples at a time) with chart recorder costs approximately $5,500 to $6,000. If an eight-cell assembly is desired, the additional cost is $4,000.

OTHER BODY LEAD MEASUREMENT

Lead in Excretions. High concentrations of lead in feces and urine provide semiquantitative evidence of exposure and intake of lead. Measurements are customarily made by standard chemical methods. Use of urine for lead screening is not recommended.

Lead in Hair and Teeth. Endogenous lead in hair is indicative of past exposure. Analyses can be carried out by standard wet chemistry, by atomic absorption spectrophotometry, and by anodic stripping voltammetry following chemical digestion of the sample.

INDIRECT SCREENING METHODS

Other biochemical substances are associated with current or past exposures to lead. These are delta-aminolevulinic acid (ALA), aminolevulinic acid dehydrase (ALA-D), and the protoporphyrins. The substances are involved in the biosynthesis of hemoglobin of the red blood cells. The accompany chart shows major steps in the synthesis and the steps affected by lead (Figure 2).

METHODS FOR DETERMINATION OF LEAD IN SURFACE COVERINGS

There are both destructive and nondestructive methods for determination of the lead content in paint. Quantitative measurements of samples of surface covering can be made in laboratories by standard chemical methods. Semiquantitative destructive screening tests have also been developed.[32,33]

An outline of reactions entering the formation of heme is shown in Figure 2. The presence of lead interferes at several stages of the chemical reactions; these stages are referenced by numerals.

1. Excessive ALA synthetase and overproduction of ALA in the liver. Lead intoxication is associated with a tenfold to fortyfold increase in urinary ALA.
2. Reduction in the activity of ALA-D. There is a negative correlation between blood lead concentration and enzyme action.
3. Tenfold to fortyfold increase in coproporphyrin.

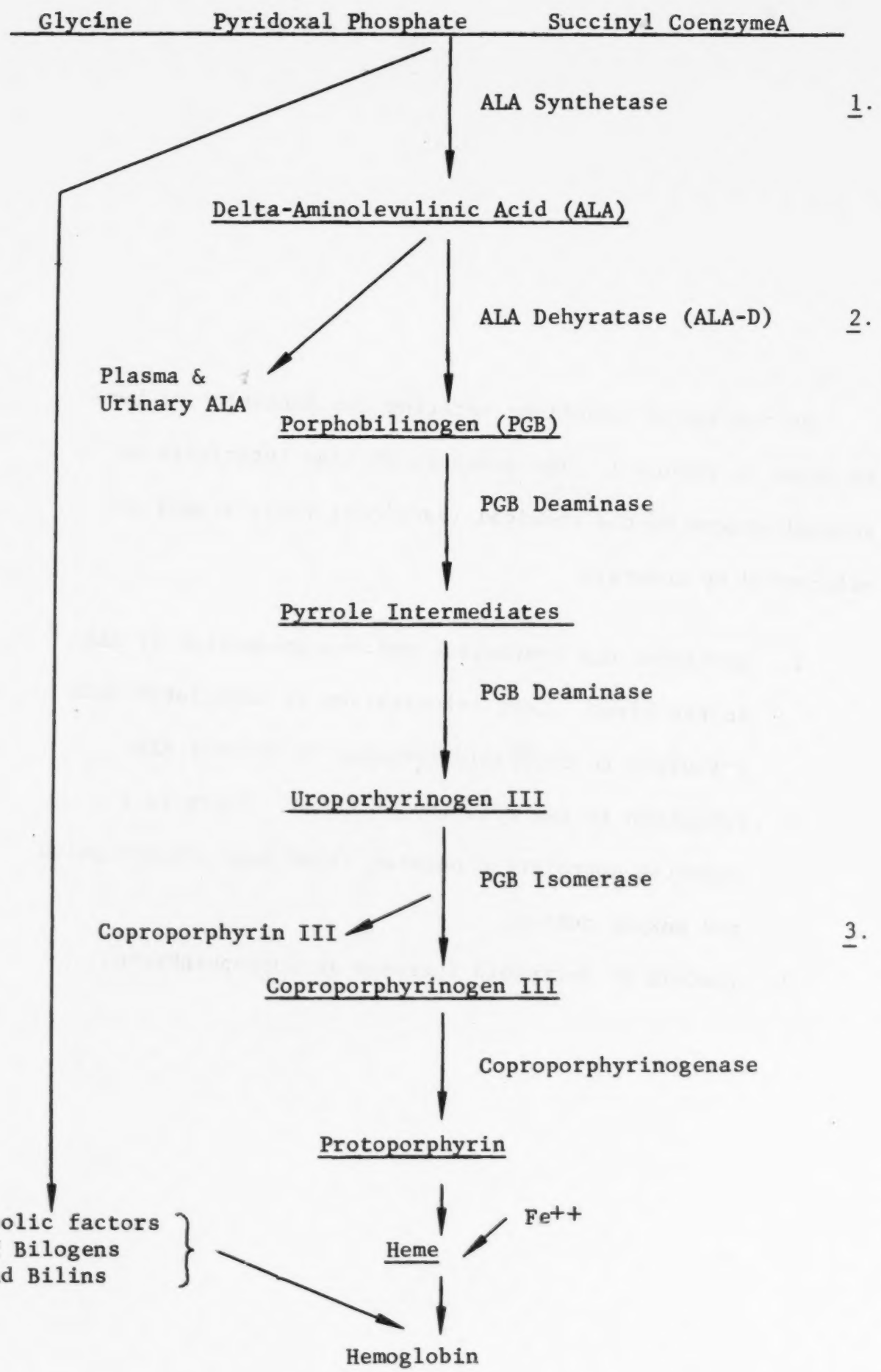
Glycine
Pyridoxal Phosphate
Succinyl CoenzymeA
ALA Synthetase
1.
Delta-Aminolevulinic Acid (ALA)
ALA Dehyratase (ALA-D)
2.
Plasma &
Urinary ALA
Porphobilinogen (PGB)
PGB Deaminase
Pyrrole Intermediates
PGB Deaminase
Uroporhyrinogen III
PGB Isomerase
Coproporphyrin III
3.
Coproporphyrinogen III
Coproporphyrinogenase
Protoporphyrin
Anabolic factors
of Bilogens
and Bilins
Fe++
Heme
Hemoglobin

Figure 2

Nondestructive measurements can be made using radioisotope excited x-ray fluorescent analyzers (X-R-F). The instruments contain a radioisotope source that irradiates the lead atoms within the surface coverings. When the atoms are irradiated by nuclear particles they are made radioactive and emit gamma rays. The gamma rays are detected by a sensing device and counted by a counter. The instruments are calibrated to relate the counts per unit time to the quantity of lead that is present. These devices provide a practicable method for surveying a large number of areas of surface coverings within one or several rooms of a dwelling.

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PART II

PLANNING A CITY PROGRAM FOR LEAD CONTROL

Essentially, a given city's program for dealing with lead hazards consists of three parts: identification, including case-finding; environmental control, including treatment of victims of lead intoxication; and elimination of sources. Some activities in the program cannot be performed until others have been implemented.

A city may well benefit, however, from an educational, motivational campaign to inform its citizens of the dangers of lead intoxication without necessarily taking action to delead all of the apartments in the inner city. Conversely, a case-finding program would likely prove futile without some kind of community awareness of the problem. It is to be expected, however, that, once the affected community is aware of the potential for lead poisoning, citizen pressure will be brought to eliminate the hazard.

Some cities may be reluctant to allocate scarce tax dollars to the program, maintaining there is no lead problem, or that it is at least minimal in terms of priorities when compared to more obvious environmental insults. There is as yet no reason to believe lead poisoning is endemic to only a few large cities. Rather, the studies indicate the problem of lead intake is in some degree universal, but is recognized only in those areas where an attempt is made to identify the hazard. We can assert with conviction that a child with an elevated level of lead in

his blood will suffer. His tolerance for junk-car bodies is less well established; yet, there is a consensus that old car bodies affect his mental health. This is perhaps an over simplified characterization of the selection of priorities for funding; but, in the final competition for resources, just such cost-benefit analysis will have to be made.

POLICIES IN INITIATING A LEAD-CONTROL PROGRAM

Before a city undertakes a lead-control program, it must be understood that, even though the decision to fund the effort may come from the city council or county commissioners, the chief executive of the city government must vigorously support the concept. This is true because the progression of activities will inevitably lead to involvement of a number of intra-city governmental departments. A lead-control program cannot be just a "health project" or a "housing ordinance enactment." It has elements of both, and it is neither feasible nor desirable to begin a lead-control program with a few thousand dollars tucked away in a multimillion-dollar housing or health department budget. Welfare agencies, schools, and organizations of the type of the Office of Economic Opportunity (OEO) will participate to a greater or lesser degree.

The city also must understand that successful lead control measures will initially increase in cost as more lead hazards are identified. This will be true whether a total lead program is carried out, or only parts are selected for implementation.

The point is made not to discourage those who would support lead control, but to establish a realistic basis for continuing support. A common criticism by state and local governments is that most Federal monies, grants, pilot programs, etc., are used to identify a need for service. They are then terminated on the assumption the State will assure continuity of the program on the basis of the desirability established with Federal monies.

Another principle is that there would be little value in appropriating funds for casefinding in one age group for one year and then eliminating the funds in the next year. This does not necessarily mean an "all or nothing" proposition. A population educated to the danger of lead poisoning is infinitely better off than one ignorant of the consequences of children consuming chipped paint. A one-year program would benefit only those small numbers of the total cases so identified and would likely cause anxiety among the populace when discontinued.

Another policy is that specific goals must be established at the outset in order that the evaluation process used may give a true picture of the program in progress. Short range goals could be: 1) organization and staffing of the agency, 2) establishment of liaison with neighborhood organizations and other city departments, 3) beginning of the operations in community education and screening, 4) establishment of the selection of geographical areas to be tested on a systematic basis. Longer range goals include: 1) legislation, 2) firm programs to delead and renovate housing units.

It is important that clear-cut objectives be established and priorities reviewed. If these ends are limited and realistic, the probability of continuing fiscal support is greater. Removal of lead from the environment is a long-range program goal, more so than some other public health problems. We are stressing this fact, hopefully, to prevent the occurrence of a "bold new program" syndrome wherein a program is budgeted, launched with fanfare, and then is unable to reach the objectives set by its sponsors resulting in a consequent lessening of fiscal support in succeeding years. A prosaic beginning will ultimately yield greater return, for the results may then be compared favorably with expectations.

Finally, each city must develop and follow a plan of attack specifically tailored to its unique needs. The size of the problem will vary even among cities of the same population, depending on the age of the city, geographical location, ethnic makeup, and the migration patterns. Examples in this document often use a figure of 500,000 population, but a number alone may not be a valid basis for scaling up or down the size of the operation. Some cities may have much greater resources available in terms of manpower already working on similar programs. Others may find that the people in the community are more receptive to the program because of previous experience with the health department or other city agencies.

Evaluation - It may be difficult to prove the city is getting a fair return for its money on lead abatement unless you have included evaluation methodologies within the program.

Lead control operations will in the last analysis, be judged on the number of cases extant before and after measures are completed. During the interval between the initiation and final appraisal of the program, continuous analysis should be carried out in order to determine the efficiency of the various components.

Often we hear the old cliche, "if one child is saved, the effort was worth the expense." This kind of rationalization will not stand the scrutiny of hard-nosed custodians of tax dollars. In order to be effective, evaluation must be an integral part of each component of the whole, be conducted regularly and not confuse activity with results. Organizational activity is measured by recruitment of people who get things done, not by number of committees appointed. Education is measured by the number of people motivated to actively participate in screening, not by the amount of money spent on materials distributed or on television announcements. Casefinding is measured by the number of patients identified with increased lead contact, not just by the number of patients examined.

It is apparent that the evaluation process will concern itself with numbers of things accomplished, not merely measures of activity. An efficiently managed lead control effort can withstand the toughest kind of statistical cost-benefit analysis if these evaluation processes are ongoing rather than in response to a critic after the program has been in operation.

STEPS IN PLANNING AND EXECUTING A LEAD CONTROL-PROGRAM

An example of an unsystematic approach would be to lobby for legislation, only. This could be an error, regardless of whether or not successful. If an ordinance is obtained which requires the removal of lead paint there may be created among the authorities the idea that the problem is on the way toward solution. What is more likely to happen is that because of insufficient mobilization of the community, opposition will develop from vested interests, who will not only try to block the legislation, but will prevent a lead program from ever developing. If legislation is enacted and vigorously enforced, without any additional funding or other incentives, this may lead to abandonment of property or conversion to commercial use.

In developing a systematic approach to elimination of lead a specific sequence of steps is necessary.

The "prime movers" in the city, including those living in the ghetto area, must become concerned about the lead problem in children. These people may or may not be a part of the medical community, but the eventual involvement of both private medicine and public health is needed.

These "prime movers" must first convince the local government that the economics of restricting lead poisoning among children warrant the costs involved. The overwhelming majority of cases of lead poisoning is found in children where it can cause not only suffering, but the greatest economic loss--for medical care, continuous support and loss of future earnings.

We have discussed the role of community leaders in motivating the heads of local government, for the nature of the problem is such that strong administrative support must come from the top. This means that the director of the lead-control program must have access to the mayor, regardless of where the organizations' budget originates, whether from the health department, housing, or independently-allocated funds. The objectives of the lead-control measures may not always coincide exactly with the day-to-day operations of the sister agencies; and, if conflicts arise, there must be access to a higher authority for their resolution.

The second step is the establishment of a staff for the lead program. The size of the staff will depend on the size of the city and the goals set for the program. The size is much less important than the composition and competency of the individuals. There is no need for a full-blown staff initially; a chief, a deputy, and a secretary might suffice for three or six months. What is needed is a full-time administrator who can get things done within the city administration, who relates well to the affected population and who can carefully lay the framework for the larger staff.

There is often a tendency to get the "show on the road." In this case, it might take the form of beginning a casefinding or survey program immediately in order to try to show the magnitude of the problem. In beginning a casefinding program too quickly, the

error is that the results may well be inconclusive; after the first group of patients have been found, there would be no mechanism to ensure a large enough sample from which to draw epidemiologic conclusions.

Within three months, the nucleous of the staff should have finalized a time-phased total plan wherein components of the operation mesh. The existence of this plan is part of that principle related to periodic and routine evaluations mentioned earlier. The concept of having the director of the lead-control program plan and subsequently carry out the activity is dictated by necessity. It is extremely unlikely that a city would be able to hire a person who is both experienced in dealing with the overall problems related to lead poisoning and who possesses administrative expertise.

The third step is to mobilize an educational effort concerning the problem of lead. Of necessity, some education has been carried on in the upper echelons of local government and with community leaders in order to develop the plan thus far. This education should be phased to maximize the effect with respect to the total program. The effort should expand from the professional medical people and the government agencies, step by step, down to the general public. The Community Awareness and Education section of this document deals with these educational steps.

Casefinding is the fourth step. The singular and most important facet of casefinding is to remember that for the purpose of

this program it is but a tool to attack the larger problem of lead in the environment. When children are found with elevated levels of lead in their blood, it proves that the proper group is being tested. It means that we have discovered a child who can lead us to hazardous sources of exposure. This source must be eliminated. The removal of the child and his subsequent treatment constitute a separate, but associated problem.

Realistically, the success, or lack of it, of a lead program is likely to be the casefinding section. If no children are identified, or if the ratio is markedly below what has been found in programs carried on previously, the casefinding methodology should be carefully reviewed. After a periodic evaluation of the results, and after any changes and procedures that may be warranted have been initiated without influencing the findings, the program should be terminated.

Obtaining fiscal and legislative support for a total effort is the fifth step. Some actions in a lead program must be carried out sequentially, others may be carried out in parallel. Discussion of funding has been deferred to this point in order to emphasize that total fiscal support from outside the city may depend on how well the earlier stages have developed. In other words, the success of the casefinding program should support the funding and legislative efforts even through these activities may have been carried on concurrently.

The magnitude of the costs of the various elements of the program are approximately 10 percent for the identification of the lead, and 90 percent for the removal of the source. Without attempting to equivocate on the estimate, a number of points relevant to the costs are made.

1. Presently, Federal support is quite limited; and it will be difficult for a city to obtain it without matching funds.

2. The identification of the lead problem--including education, casefinding, and sampling dilapidated homes--will remain a program financed by government regardless of how the deleading is financed.

3. There will be a tendency for local legislative bodies, particularly if the Federal government has not yet made large-scale grants available, to legislate specifically against owners of buildings where the hazard exists. This may not accomplish its intended purpose for the legislation could result in increased rental, attempts to abandon buildings or refusal to rent to families with children. Such legislation may not be necessary since means of enforcement involving penalties for violation of health ordinances may already exist. If specific legislation is necessary, recognition should be given to establishing equitable means of partially defraying costs, including potential sources of Federal, State, or municipal funds for rehabilitation or renovation.

4. A permanent organization within the city--either public health or public housing--must be staffed to ensure compliance with lead control measures and maintain continuing surveillance.

5. Deleading the environment is the ultimate objective. The technology to remove the hazard exists; only the means to effect it remains in doubt. There are a number of potential sources of lead poisoning impinging on man--vehicle exhaust, lead in water pipes, and aerosol-borne lead--these are but a part of the total problem. The presently identified problem of lead poisoning from ingestion of chipping paint is the major concern. Local government has the power to attack lead without waiting for additional breakthrough in technology.

PART III

COMMUNITY AWARENESS AND EDUCATION

For a lead program to be truly effective and to gain maximum support from segments of the community most directly affected, it must be carefully and systematically planned with the people involved. The importance of community participation in health affairs has long been recognized, but some health departments in recent years have had difficulty in communicating effectively with low-income people. Health department projects are beginning to recognize the need to include representatives of those groups who are to participate. Communities composed of poor, minority groups--Blacks, Puerto Ricans, Mexican Americans, Appalachians, and Indians--will never get involved in a lead program run by professionals who do not involve them in the planning and implementation.

Many undertakings have been developed on the basis that community-wide education and teaching efforts that show people how to get to health facilities are all that is needed to deal with a problem. Community awareness of lead poisoning alone is useless, however, unless the city develops a workable system to detect and treat cases of lead intoxication and to control exposure sources.

To implement a deleading campaign that relates to the life-styles and needs of poor people, the following suggestions are advanced:

1. A lead poisoning task force of neighborhood people should be established. This task force would help to plan the lead-

control strategy so that it is relevant to neighborhood people and will develop educational and promotional techniques that can be useful and effective in mobilizing the community.

2. A full-time community organizer or health worker should be assigned to work with and staff such a task force after it is organized.

3. A professional advisory committee composed of doctors, hospital administrators, school officials, and business and labor leaders should be appointed by the health commissioner. The function of the advisory committee is to provide technical assistance.

Health department professionals should be prepared to deal with conflict. The residents who make up the task force are action-oriented and may make demands that professionals may feel are unreasonable.

The task force, the health department staff, and the professional advisory committee will provide a broad-based coalition to carry out the lead control measures. For this coalition to remain productive, the health worker should devote time to making sure that each group is aware of what the other is doing.

Each group should be recognized for its area of competence: the task force for its knowledge of community conditions and life styles of the people, the health department for its knowledge of public health and prevention programs, and the professional advisory group for its technical knowledge.

By working together on the problem of lead poisoning these groups, perhaps after some initial hostility and suspicion, will begin to operate in a manner that will benefit all concerned. By providing a mechanism for desperate groups to meet and reach a consensus, new relationships and modalities of operation will begin to emerge. Such relationships, strengthened by debate and contact, also can be useful in future programs designed to meet other urgent health needs that face the people of the city.

Education-information activities will be required to facilitate community awareness, understanding, and support. The activities would be directed at these target groups: the general public, parents, older brothers and sisters, and others who care for small children; public health, housing, and welfare workers; physicians, nurses, and paramedical personnel, and laboratory workers.

THE GENERAL PUBLIC

The community program designed to control lead hazards to children should include a continuing flow of information to the public about the extent and nature of the problem, progress of the community program, and when and where specific activities, such as casefinding, are being carried out. This information could be provided through radio, television, newspapers, posters, literature, mobile sound units, and a speaker's bureau.

PARENTS, OLDER BROTHERS AND SISTERS, AND OTHERS WHO CARE FOR SMALL CHILDREN

Parents and other individuals who care for or supervise small

children need to acquire enough general information about lead poisoning in children to influence them to develop the attitudes and actions basic to a lead-control program. These individuals could be assisted in recognizing potential sources of lead poisoning--such as peeling or flaking paint--and in adopting procedures that can be taken to reduce the exposure of children: good housekeeping, better supervision of children, scraping and removing loose or peeling paint, and reporting such a condition to the property owner and to health or housing authorities. Information also could be provided about pica and other behavioral symptoms that indicate the need for medical evaluation and about where and how such assistance can be obtained. These individuals could be motivated to participate in screening programs designed to detect children with elevated body burdens of lead and to encourage others to do likewise.

A variety of methods and approaches can be utilized to provide information to this target group and to motivate them to take desired actions.

These include:

1. Personal counseling by public health nurses, sanitarians, housing inspectors, welfare workers, physicians, and others in health-care facilities and screening centers;
2. Contacts by health education aides who are community residents;
3. Education of new mothers;

4. Participation in group discussions at block meetings and other places of assembly;

5. Education in the schools.

The school environment in endemic areas can provide an atmosphere for discussion of the lead problem and its control. This can be accomplished through adult education classes and by providing information to older brothers and sisters on the hazards of lead in the environment. The school nurse can be stimulated to assume an active role in recognizing lead signs and symptoms in children. The teacher has an opportunity during discussions about the home environment to learn of situations and activities in the students' homes that suggest the possibility of lead poisoning. Industrial arts classes in schools located in areas of high incidence can include deleading methods in their curriculum. School staffs can then make appropriate referrals pertaining to diagnosis, treatment, and control.

PUBLIC HEALTH, HOUSING, AND WELFARE WORKERS

All public health, housing, and welfare workers need to acquire familiarity with basic scientific knowledge concerning lead and its effects upon children. They should utilize every opportunity to inform parents and others who care for children about the hazards of exposure to lead and desirable actions that individuals and groups can take to reduce the exposure or to obtain treatment if it is required.

Early in the development of a community action program professional public health, housing, and welfare workers should become knowledgeable about the lead problem and the program being developed to control it. This background of information should include: the extent and nature of the problem, casefinding methods to be employed, some knowledge of diagnosis and treatment procedures, identification of lead sources and methods for removal of lead from the environment, methods to be followed in referring information about health and housing problems so that action can be taken, and legal foundations for the community action program.

These individuals can best receive the necessary information through formal inservice training courses. A 2- or 3-day training course should provide ample time for instruction. Courses probably will have to be repeated at intervals of about 6 months to insure that all new employees are thoroughly informed.

PHYSICIANS, NURSES, AND PARAMEDICAL PERSONNEL

Medical and related professional personnel need to acquire scientific and clinical medical knowledge about lead and its effects upon children and to maintain during their practice a high index of suspicion for possible cases of elevated body burdens of lead. These individuals need to be knowledgeable about methods of diagnosis and treatment of lead intoxication, the community program being implemented, reporting of cases, referral procedures for environmental control, and new research findings pertaining to the control of lead hazards to children.

The health department, working through professional organizations and professional schools in the community, can stimulate development of refresher courses, seminars, and conferences for professional personnel. Articles describing the community action program also can be placed in the newsletters of professional societies and representatives of the health department can discuss the program at meetings. A planned systematic information campaign will be needed periodically to remind the professions of the community's program for controlling lead hazards in children and to maintain a high level of public awareness.

LABORATORY WORKERS

Laboratory workers involved in the analysis of biological specimens or paint for lead content need to acquire certain basic scientific knowledge about lead and its effects upon children, and to develop technical skills in laboratory procedures.

Reliable and accurate lead analyses require highly trained personnel and rigid procedures. Sample contamination is not an infrequent occurrence in many laboratories. Since most clinical and public health laboratories do not routinely perform large numbers of analyses for lead, special training is essential.

A training course of two or three days duration for all personnel involved in lead determinations should be conducted early in the development of a community action program.

PART IV

CASEFINDING TO IDENTIFY CHILDREN WHO HAVE INCREASED LEAD INTAKE

COMMUNITY APPROACH

The objective of this guideline is to offer methods that can be used by a community to identify those children who have high burdens of lead in their bodies. Early identification would make early treatment possible for children with either minimal or early signs of lead intoxication.

The guidelines that will be discussed are recommendations and suggestions that must be shaped, adapted, and implemented according to the specific, and often unique, needs and resources of the community considering them.

Once a childhood lead problem is shown to exist, provisions should be made to continue the casefinding program for as long as it takes to make the lead hazards unavailable to all the children. Casefinding should be conducted yearly, with more frequent followup of certain high-risk groups. Some studies have pointed to a decreasing number of cases of lead poisoning, after an initial screening program, as evidence that the program is decreasing. This may be a false hope -- the result of a relaxation in the levels of awareness by the casefinding team. Success is achieved only when the sources of hazardous lead have been made unavailable to children. A thorough casefinding program can also be considered successful if it has demonstrated that no lead hazard exists in the community.

COOPERATING AGENCIES AND POPULATIONS

An effective lead casefinding program must be accompanied by a community education and awareness program directed at the prime movers and the potential manpower in the community. An alert and informed parent will ultimately become the best casefinder.

Ideally, the initiative for beginning a lead casefinding program should come from the community involved. There are two major groups in the city that should plan and participate in these processes. They are the city's health professionals -- that is, the health department and medical practitioners -- and the citizenry. Either group may take the first step so long as communication and cooperation are started and maintained.

ADMINISTRATIVE RESPONSIBILITY

A technically qualified coordinator for the casefinding program should be chosen from one of the major groups of the city. He should maintain close liaison with the intracity neighborhood councils and the city health professionals.

DEFINITIONS

Standard terminology should be used within the community and in exchange of information among communities. Definitions of some of the principal terms are given below.

Degrees of Lead Exposure

Undue lead absorption. A condition in which the blood lead concentration exceeds 40 µg/100 ml of whole blood, determined on two separate occasions.

Suspected lead poisoning. Blood lead levels of 50 to 79 µg/100 ml and (1) with one or more clinical signs, such as abdominal pain, loss of appetite, constipation, and central nervous system effects; (2) without clinical signs but with positive findings in one or more screening tests (urine ALA, serum ALA, urine coproporphyrin, serum ALA dehyrogenase, serum protoporphyrins, hair, basophilic stippling of red blood cells, "lead lines" in x-rays of long bones, radio-opaque materials in flat plate of abdomen); or (3) without clinical signs but with a history of pica.

Lead poisoning. Blood lead levels of 80 µg/100 ml or more, regardless of absence of clinical signs or lack of other laboratory findings; encephalopathy, with a history of exposure to lead, regardless of blood lead levels.

Population at Risk

1. All children aged 1 to 6 years: from deteriorated dwellings; relatives and playmates of children with lead poisoning; or those living at addresses of known cases of lead poisoning; or living where paint samples with high lead content have been found.
2. All children with a history of pica.

3. All children exposed to other special local conditions involving lead hazards.

High Risk Area

Deteriorated houses, principally those built prior to 1940.

THE LEAD CASEFINDING PROGRAM

The program may be subdivided into three interdependent parts: screening, followup, and reporting.

SCREENING

A screening program requires identification of the population at risk, detection of elevated body lead burdens and methods for setting up facilities. The details of recommending priorities for initial screening also will be discussed.

Detection

At present, blood lead appears to be the most consistent indicator of acute exposure. It is recommended that all cases be reported in terms of micrograms of lead per 100 milliliters of whole blood. It is recognized that other methods are valid and useful for initial screening. Information on new methods and developments will be made available to communities upon request to the Bureau of Community Environmental Management. A brief summary of the types of techniques are presented here (see also Part II).

1. Blood

Macro methods (more than 1 ml blood)
Lead: atomic absorption (AA)
dithizone

Other indicators: serum delta-aminolevulinic acid (ALA)
serum delta-aminolevulinic dehydrogenase (ALA-D)

Micro methods (equal to or less than 0.1 ml)
Lead: atomic absorption
anodic stripping voltammetry (ADV)

Other indicators: protoporphyrin
basophilic stippling of rbc's

Hemoglobin, hematocrit - an indirect method that is nonspecific

2. Urine

Lead: AA
dithizone
ASV
provocative chelation with Ca-EDTA

Other indicators: coproporphyrin
ALA
protein elevation

3. Hair

AA
ASV
dithizone

4. Radiography

radio-opaque materials in flat plate of abdomen
"lead lines" in long bones

Priorities

It is recommended that priorities be established in childhood lead-contact screening programs. The purpose is to minimize the

likelihood of permanent impairment among those with lead poisoning, to prevent poisoning among those who have high blood levels, and reduce the risk of further exposure. These are:

1. Children of all ages who have known symptoms of lead poisoning;
2. Children of all ages who are known to have elevated levels of blood lead.
   a. 80 μg/100 ml and above
   b. 50 to 79 μg/100 ml
   c. 40 to 49 μg/100 ml (those under 3 years of age have priority);
3. Children of ages 1 to 6 (those 18 to 30 months first) who are siblings, relatives, or playmates of known lead poisoning cases;
4. Children of ages 1 to 6 (those 18 to 30 months first) who are living at addresses of known lead poisoning cases or where samples of paint with high lead content have been found;
5. Children of all ages who have a history of pica;
6. Children of ages 18 to 30 months, for initial screening.

The names and addresses of the children in the above categories and the results of investigations conducted during the screening phase should be recorded in a central registry. The children should be followed medically after the initial screening.

Spring and early summer are recommended for screening, although lead poisoning occurs throughout the year.

Approach to Obtaining Blood Specimens

The least costly approach to obtaining blood specimens is through the use of existing manpower. Where there are no designated children's lead poisoning control clinics, care must be taken to ensure that hospitals, clinics, health centers, and practicing physicians are made aware of the city's lead program. Instructions and lead-free kits for obtaining blood specimens should be provided. Specimens could be picked up or mailed to a designated laboratory for analysis. The approximate cost per case for this includes: mailing - 25 cents per case; salaries - no additional cost; and equipment - 40 cents per case. The total cost for 25,000 cases would be about $16,250. The size of the child population is an important factor in estimating the number of special clinics or mobile health vans needed. Estimates based upon average values show that about 6 percent of the population of a metropolitan statistical area are between 18 and 36 months of age and 10 percent are between the ages of 1 to 6 years.

Specimens also may be obtained through the establishment of full or part-time lead evaluation clinics. Existing child care clinics and Head Start programs may be employed. Such a clinic would have the capability not only to collect blood specimens, but also, when necessary, to evaluate and treat, as an outpatient, a child with an increased body burden of lead.

At least one physician, one nurse, one clerk, and a minimal amount of equipment would be required for each special lead evaluation clinic. Children could be referred to the clinic by parent awareness programs about pica by caseworkers, by community action groups, and by identification of previous cases in the family or at specific addresses within the clinic's area. The cost to screen and evaluate 25,000 children per year by this method would be: salaries, $66,000 (excluding those for community representatives); mailing and equipment, $16,000; total -- $3.00 per case ($75,000 per year for 25,000 cases). At least two full-time or five part-time centers would be required for 25,000 children per year.

Mobile vans and block-to-block demonstrations, manned by volunteers from community groups and medical schools, can be used to supplement the fixed facilities. Where micromethods are used for blood lead determinations, specimens may be drawn by visiting nurses or technicians.

FOLLOWUP AFTER INITIAL SCREENING

Diagnosis

All children found to have indications of increased lead body burden in screening will be handled in the following manner:

Those with a positive nonspecific screening test and who are asymptomatic but have not had a blood-lead determination. A blood-lead determination will be made either in a designated clinic or in

a hospital emergency room. If the blood lead level is negative (under 40 μg/100 ml) and the child is asymptomatic, a repeat blood sample will be drawn. If the blood lead level continues to be negative and the child still lives in a leaded environment, the child should be followed monthly during the summer, and every 3 months thereafter until the child is removed from the source of exposure or until he reaches six years of age.

Those with a positive nonspecific screening examination and who are symptomatic but have not had a blood-lead determination. The patient will be sent immediately to a hospital emergency room for medical evaluation and blood lead determination.

Those with blood-lead levels over 40 μg/100 ml on screening examination. Where blood-lead has been measured in the screening program and has been found to be in excess of 40 μg/100 ml, the following order of priority of action is recommended.

80 μg/100 ml or above. Regardless of symptoms or other laboratory findings, these children must be considered cases of lead poisoning and handled as medical emergencies with hospitalization and chelation therapy. Encephalopathy, with a history of exposure, should be treated in a similar manner, regardless of blood lead level.

50 to 79 μg/100 ml. Immediate recall of the child must be made for medical evaluation at a clinic or hospital for possible lead poisoning.

1. If symptomatic, the child should be considered to have lead poisoning.
2. If asymptomatic and still exposed to lead, the diagnosis may be confirmed (and the decision to treat) by placing the child in a safe environment and repeating the test for blood lead. If the repeat specimen is again 50 to 79 µg/100 ml and any of the following tests are positive, the diagnosis is confirmed:
   a. Urinary excretion in 24 hours of more than 1.0 micrograms of lead per milligram of Ca-EDTA administered intramuscularly at a dose of 50 milligrams per kilogram of body weight -- the total dose not to exceed 1 gram of Ca-EDTA;
   b. Serum delta-aminolevulinic acid (ALA) level of greater than 20 micrograms per 100 milliliters of whole blood, using the Haeger-Aronson method;
   c. Urinary output of coproporphyrin greater than 150 micrograms per 24 hours;
   d. Urinary output of delta-aminolevulinic acid greater than 5 milligrams per 24 hours;
   e. The presence of basophilic stippling of red blood cells, "lead lines" in long bone x-rays, radio-opaque material in the abdomen, or a strongly positive urine spot test for coproporphyrin may be

considered indicative of high lead exposure when laboratory facilities for making the tests designated above are not available.

3. If asymptomatic and negative findings occur upon confirmation tests, these children should be followed closely with monthly tests for blood leads, and should be removed from hazard.

40 to 49 µg/100 ml whole blood. Immediate recall of the child must be made for repeat tests for blood lead, and inquiry concerning pica and the child's current exposure to lead.

1. Those who continue to be exposed, with repeat values of 40 to 49 µg/100 ml, and are asymptomatic, should be followed closely, with determination of blood-lead level every 6 to 8 weeks -- more often in the summer. Priority should be given to the children under 3 years of age.
2. Those whose levels are 40 to 49 ug/100 ml on repeat sampling, and are no longer exposed, need not be followed until the next year's screening.
3. Symptomatic children with a history of exposure, regardless of blood levels, should always be immediately referred to the hospital.

Treatment after Diagnosis of Lead Poisoning

Standard chelation therapy is recommended. Penicillamine may be employed where indicated. Therapy should be monitored with blood lead determinations.

Discharge after Treatment

No child should be sent back to his home until the source of lead exposure has been identified, eliminated, or made unavailable. The use of convalescent houses, halfway houses, public housing, or hazard-free relatives homes could be employed here, while the child's home is being repaired.

All children must be followed at least yearly, until age 6, or longer, in order to detect repeated lead exposure and prevent poisoning.

All children should be given adequate neurological and psychological assessment at the time of diagnosis, and in ensuing years, to detect any neurological or behavioral deviation, including minimal brain disfunction, so that proper therapy and school placement can be instituted.

All other children who are under 6 years of age and who are living or playing at the address of the discharged child should be screened for elevated lead burdens.

Special lead clinics or existing community facilities for comprehensive care should be utilized to follow-up the children who have been discharged.

A followup team of visiting nurses and sanitarians should regularly visit the involved dwellings to make sure that the child is no longer exposed to lead and has remained in good health.

The details of successive steps should be recorded in the lead registry.

REPORTING

The various phases of screening, diagnosis, and followup must be coordinated to avoid duplication and the loss of continuity of care. To accomplish this end, an organized reporting system must be established.

Lead poisoning should be considered a reportable disease. A lead registry should be established to maintain complete records of the essential elements of the child lead control program.

Sources

The register would include all children with a history of exposure, pica, blood-lead levels above 40 μg/100 ml, positive screening tests, or lead encephalopathy. Children under age 6 who are relatives, or who live or play at the same address, also should be included.

All laboratories doing blood-lead determinations should be required to report the results of all samples -- together with the name and address -- to the lead registry. This would apply to those even below 40 μg/100 ml.

Forms

A uniform reporting form should be used to record information from screening programs, hospitals, clinics, and private physicians within the community, in order to provide the lead registry with comparable data and meaningful statistics. There may be reports

from five potential sources of information: screening program or physician, diagnostic clinic, hospital, housing and medical followup agencies. Separate forms for each source or a single form with multiple carbons may be used. The important thing is that the time required to complete the form be kept to a minimum.

The following items should be expected from the reporting sources (in addition to name, unit number, birth date, age at time of examination or report, address, and apartment number):

1. Screening program or physician

   a. Name of screening agency or private physician
   b. Reason for screening
   c. Source of lead
   d. Laboratory data - dates and type of method
   e. Symptoms
   f. Disposition of case and whether family or dwelling was studied

2. Diagnostic clinic

   a. Name of diagnostic clinic
   b. Reason for referral and source of patient
   c. Laboratory data - dates and type of method
   d. Symptoms
   e. Disposition of case and treatment, if any

3. Hospital

   a. Name of hospital
   b. Reason for referral, and source of patient
   c. Laboratory data - dates and type of method
   d. Treatment
   e. Complications
   f. Length and cost of stay
   g. Disposition of case

4. Housing agency or sanitarian

   a. Name of inspector or agency
   b. Reason for inspection--reported case or building survey
   c. Condition of dwelling
   d. Measurement data - paint chips, wall detectors, laboratory or other
   e. Recommendations - rehabilitation or repair
   f. Disposition of case

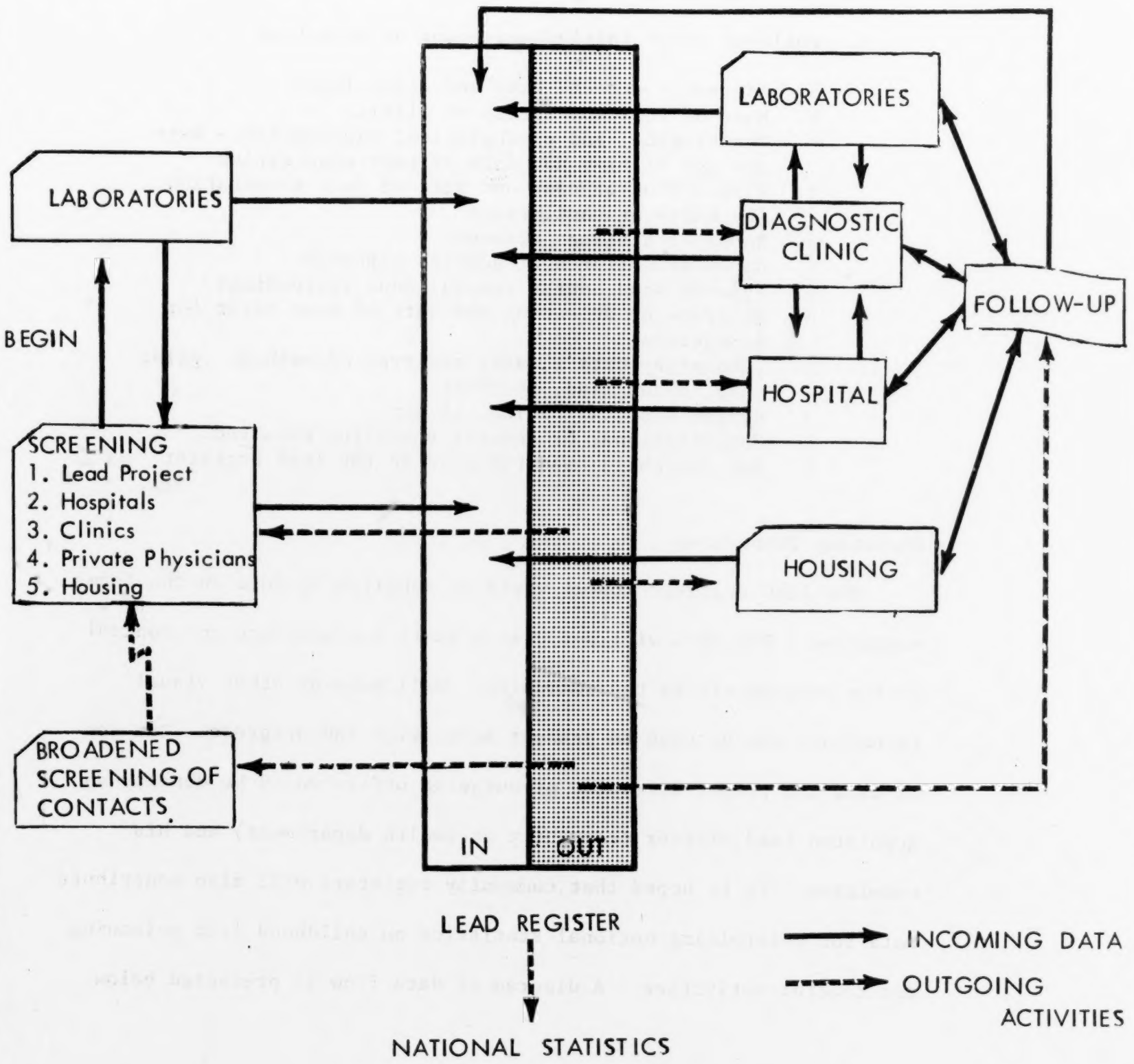
5. Followup after initial screening or admission

   a. Address - street, city and state (new)
   b. Name of followup agency or clinic
   c. Neurological and psychological examination - date and age at time and date of next examination
   d. Disposition of case and date of next examination (by nurse or sanitarian)
   e. Names of siblings screened
   f. Names of children at address screened
   g. Type of lead source removal done (deleading)
   h. Progress of deleading and date of next visit for inspection
   i. Laboratory data - dates and type of method: paint chip, blood lead, or other
   j. Repeat hospitalization, if any
   k. Complications, or special schooling required
   l. Has the child been recorded in the lead register

Operating Procedures

The lead register itself would be supplied by data on the forms suggested. The data will serve as a basis for guidance and control of the program within the community. Wall maps or other visual techniques can be used to present activities and progress. The use of data and proper direction of outgoing orders would be done by an appointed lead officer (community or health department) and his committee. It is hoped that community registers will also contribute data for determining national statistics on childhood lead poisoning and control activities. A diagram of data flow is presented below.

Figure 1 - Diagram of Data Flow



PART V

GUIDELINES FOR DEVELOPMENT AND ENACTMENT OF LEAD CONTROL LEGISLATION

Control of lead hazards to children will require diligent application of all of the following means:

1. Active utilization of voluntary health-related standards developed by industrial and other qualified nongovernmental groups;
2. Enactment and enforcement of Federal standards, statutes, and local laws and ordinances.

The guidelines for legislative control consider two principal avenues of approach: constitutional and common law. The constitutional approach is based upon considerations of public health in which the consequences of a stress, a condition, or matter can be documented to be detrimental to health in some cases, but need not be shown to apply in every case. The common law approach involves foreseeability; it relates to liability for allowing a condition to exist that will, with considerable certainty, cause an injury or illness.

The material on approaches or procedures--together with examples of the nature and scope of Federal, State, and local legislation and legal procedure--is presented for those not

having knowledge or skills in jurisprudence. The purpose is to provide a nontechnical basis for laymen (with respect to law) to discuss their local lead problems with attorneys and legislators. Other materials in this section are to assist the layman in stating what he wants to accomplish so that attorneys and legislators can tell him how it could be done and assist in seeing that it is done.

CONSTITUTIONAL LAWS

Constitutional laws involve the relation between the individual and the public, i.e., "the people." This is in contrast to common law, which is concerned with relations between two individuals. The basis of origin of laws relevant to home rule of municipal corporations lies within the constitution of a State. This allows for enactment of statutes by the State authorizing components of city and county governmen: to issue ordinances and codes applying within their jurisdiction. For example, statutes may authorize a city code that will include a building code and a health code. Local ordinances may be patterned exactly after a State law or ordinance. In other cases, they are consistent with State legislation and may elaborate upon it.

Public health power and administration of building and housing codes are derived from the concept that police power

is that inherent sovereignty that government exercises whenever regulations are demanded by public policy for the benefit of society at large to guard safety, health, morals, and the like.

COMMON LAW

This provides for civil action involving liability of a person for injury. An example would be liability in a case of lead-paint poisoning in which a landlord or insurer was negligent in not correcting a condition which, in the common experience of man, had proved to be dangerous so that injury therefrom would be foreseeable.

SCOPE OF CODES AND ORDINANCES

There are two extremes in the scope of laws, ordinances, and codes. A health code may be broad enough to cover a variety of environmental conditions. For example, a city code or ordinance may contain a section that is very broad: "any condition or thing in or about dwelling or building, or lot on which it is situated--be dangerous or detrimental to health, the Commissioner of Health may order that the matter, condition, or thing be abated, suspended, altered, or otherwise be removed, as his order shall specify." Others are specific: "all interior loose or peeling wall covering or paint shall be removed and the exposed surface shall be placed in a smooth and sanitary condition."

In the control of lead hazards to children, the emphasis should be placed upon prevention rather than upon redress for

injury. Paradoxically, enforcement of broad general laws for purposes of prevention is dependent upon the specificity of the terms that are used. If there is common acceptance of a definition of the term, it may be considered specific even though it encompasses a number of conditions, situations, or objects. For example, the term "safe and sanitary condition" is generally understood and can be interpreted as precluding the presence of peeling toxic paint chips readily accessible to children. The term "nuisance" can be defined and is generally understood. For example, dense smoke that is prejudicial to health and safety constitutes a nuisance.

A community may find that its health and housing codes and other ordinances are sufficiently broad to be employed in enforcement of lead control measures. In other cases, legislation referring explicitly to lead may be necessary or desirable.

COURT

Adjudication of health code violations could be conducted in either civil or criminal court. Enforcement of statutes may be under the jurisdiction of a criminal court when violation involves a misdemeanor. For example, Article 101, the State of Maryland's Occupational Disease Law states that "Any person, firm or corporation failing, refusing, or neglecting to comply with any rule or regulation made by the State Department of Health and the Commissioner of Health of Baltimore City, under the powers

conferred upon them by this section shall be guilty of a misdemeanor, and upon conviction, shall be fined not more than One Hundred Dollars ($100.00) for each day that such violation continues, provided that a written notice of such rule or regulation shall be served on some person in charge of the place where such violation exists prior to any prosecution for violation of any such rule or regulation."

The establishment of a Housing Court has been found to be an effective method for expeditious handling of housing and health codes; this has been used in Baltimore, Chicago, and Pittsburgh.

ADMINISTRATIVE AGENCY ENFORCEMENT

Hearings can be authorized by statute to enable an administrative agency such as a Health Department to enforce its own rules, regulations, and orders. Such a statute could further provide that any suit, action or appeal of the rules, regulations, or orders of the agency shall be advanced for trial and determined as expeditiously as feasible, and no postponement or continuance shall be granted unless deemed imperative by a court having authorized jurisdiction.

APPLICATION OF FEDERAL LEGISLATION FOR CONTROL OF LEAD HAZARD TO CHILDREN

Various agencies of the government can act under existing Federal legislation in enforcing regulations that may be considered relevant to reducing lead hazard to children. These

agencies include Food and Drug Administration, General Services Administration, Department of Defense, Department of Agriculture, Federal Trade Commission, Interstate Commerce Commission, Department of Labor and others. For example, Food and Drug Administration is concerned with regulation and labeling to control drugs, cosmetics, toys and food with respect to lead content. General Services Administration is concerned with the specification and labeling including lead-containing substances for use by the Federal Government. Interstate Commerce Commission is concerned with labeling of hazardous materials shipped across state lines. Federal regulations can be used directly as a basis for enforcement. Where it is desired to enact comprehensive legislation to cover as many different facets of the problem as possible, the Federal regulations can be used as models for some of the sections.

LEAD POISONING: A PUBLIC HEALTH PROBLEM IN MANY COMMUNITIES

Public support is essential for enactment of legislation. Therefore, it is necessary to establish in the minds of the community and of legislators that elevated blood lead in children may have serious health and economic consequences. Municipalities that have conducted lead screening studies have found elevated lead levels in the blood of 5 to 10 percent of the children tested. In many communities no lead surveys have been carried out, and there are few data on the extent of the problem in these areas.

There are, however, sufficient data to establish unequivocally that lead intake among children is an important health problem, and it is also a very important one for humanitarian, economic, and sociological reasons. (See Summaries - Part II). Legislators should be furnished with copies of statistical data and other information that supports the need for legislative action.

In a recent article on childhood lead poisoning as an eradicable disease, Lin-Fu emphasizes the continuing health, sociological, and economic consequences of the condition. She points out that many survivors of lead intoxication are left severely handicapped. In a sample of 425 Chicago children that were treated, 165, or 39 percent, had neurological sequelae. Of those with symptoms of encephalopathy, 82 percent were left with handicaps including recurrent seizures, mental retardation, cerebral palsy and optic

nerve atrophy--some had multiple handicaps. Dr. Lin-Fu reports that "The estimated cost of treatment and institutionalization to the age of 60 of a person who incurs severe permanent brain damage from lead in childhood is about $222,000" and compares this to the cost of eradication of the hazard in an "average row house."

DEFINITIONS

Terms, unless they have well known definitions--e.g., "safe," "sanitary," and "nuisance"--must be specifically defined for the purposes of enforcement. It is the professional responsibility of attorneys and legislators to determine what terms require definition and how they are defined. Many of the definitions that could be used in legislation are shown in section three of the model bill presented in this guideline.

The terms "lead poisoning," and "lead intoxication," which are synonymous, must be defined quantitatively and qualitatively for the purposes of legislation. Terms referring to medical conditions resulting from excessive lead intake must be defined quantitatively and qualitatively for the purposes of legislation. Definitions of lead poisoning, suspected lead poisoning, and undue absorption of lead have been recommended by the Surgeon General's statement of October 12, 1970, (see Part IV, Casefinding to Identify Children Who Have Increased Lead Intake).

PROVISIONS TO BE INCLUDED IN AN ORDINANCE

The nature of the various provisions, together with examples and explanations to clarify the intent, are shown below:

Nature of Legislation*	Examples and Explanations
Household use of lead-based paint, lacquer, and other surface-covering materials.	Paint and lacquer on furnishings, toys, walls, ceilings, window-sills, railings, and other surfaces.
Manufacture and sale of household lead-containing items or items covered with lead-containing materials to conform to standards.	Furniture and toys; utensils and food containers with leachable glazes, solder, or alloys containing lead.
Labeling of lead-containing material used in or around residences and other nonindustrial permises, and in agriculture.	Paint, lacquers, plaster, pesticides, dyes, and cosmetics.

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* Footnote: All legislative items except those marked with as asterisk fall within the provisions of most State and City Health Codes and Building Codes.

Nature of Legislation (Continued)	Examples and Explanations (Continued)
Safe packaging of lead-containing materials used in and around residences and other nonindustrial premises, and in agriculture.	Cans, bags, boxes, bottles, and other containers shall be capable of withstanding impact.
Disposal of lead-containing materials, their ashes and other refuse; prohibition of sale or the giving away of such material.	Regulation of disposal of batteries, paint scrapings, wood; lead impregnated materials from deleading and demolition of buildings to ensure against their being burned within dwellings; prohibition of burning in incinerators or in drums in lots or work areas.
Marketing and sale of foodstuff contaminated with lead.	Control of residual insecticides; food processing and packaging.
Residential zoning for protection against lead-containing automotive exhaust products, and industrial emissions.	Emissions from garages, parking lots, high-density traffic routes; manufacturing plants for paints, lacquers, batteries, and other sources potentially hazardous industrial emissions.

Nature of Legislation (Continued)	Examples and Explanations (Continued)
*Expenditure of public welfare funds for emergency housing, foster homes, day nurseries, and other occupied buildings with lead-based paint on interior structure or furnishings.	Control of dwellings and buildings for rehabilitation or welfare use.
Eviction from and discrimination against rental of dwelling units to families with children.	Protection from discrimination against families with children by landlords who have been found in violation of the sanitary code with respect to lead hazards, and have carried out corrective maintenance as ordered by court or appropriate authority.
Abandonment of buildings.	Payment by owner for demolition of dwelling unsafe for habitation because of lead or other hazard.
Maintenance and occupancy standards, (1) for landlords, (2) for tenants.	Safe and sanitary maintenance of parts of dwellings and dwelling units; and rooming house, dormitory and rooming units.

Nature of Legislation (Continued)	Examples and Explanations (Continued)
Powers and duties of inspection by appropriate authority.	Entering and inspecting; sampling of paint and plaster; acquisition of food containers and utensils for testing for lead hazard.
Licensing and operation of multiple dwellings.	Requirement for license; licensing contingent upon safe and sanitary conditions.
*Establishing special Housing Courts to handle housing violations.	To expedite legal action in health emergencies; to be knowledgeable in specialty area.
Enforcement by administrative agency.	Statutes to provide Health Departments to hold hearings and enforce its own rules, regulations and orders.
*Provision and support of qualified chemical laboratories for determination of blood lead levels without cost for indigent children and for others. The administration would be authorized to accept funds contributed on a voluntary basis from individuals and organizations.	To provide competent laboratory facilities and free services as a principal program for prevention of lead intoxication and sequelae.

Nature of Legislation (Continued)	Examples and Explanations (Continued)
Blood-lead determinations performed on children by municipal, State, or privately owned laboratory, and paid for by public funds, and any cases or suspect cases of lead poisoning diagnosed by physicians shall be reported to the Commissioner of Public Health or other principal health officer. The blood lead level, name, age, sex of the child, and address and social security number of parents shall be registered and kept in public health files.	Registers should be designed to identify special hazard areas, identify sequelae of elevated lead levels, and provide a basis for lead control programs.
Other legislation or sections of ordinances are concerned with notices, enforcement, penalties, appeals, severability, and other items normally included by attorneys and legislators in such codes.	
*Property owners to receive tax benefit for controlling lead hazards.	

MODEL ORDINANCE

An ordinance of broad scope is submitted as a model that can be adopted to fulfill the legislative needs of a community to establish and enforce a lead control program directed specifically toward the protection of children. It can serve as a basis for a bill, code, or ordinance. The model can be used in part or in its entirety. The individual sections can be used to revise, strengthen, or extend existing health and housing codes and other ordinances. The intent is to control all sources of lead exposure that may be hazardous for children, primarily through diligent enforcement of effective health and housing codes. Most provisions would also help to protect adults in the home and in other non-occupational environments.

In developing appropriate legislation, it should be recognized that ingestion of lead-based paint is generally acknowledged to be the principal source of lead poisoning in children today. As such, it is a first priority consideration. It should be further recognized that there are other sources that contribute to the total lead intake. Most are endemic hazards existing at various levels of intensity for various periods of time. In addition, in the burning of lead and lead impregnated materials, an epidemic involving numbers of persons in a given neighborhood might occur.

It cannot be too strongly emphasized that an effective control and prevention program must be comprehensive in scope. It is important not only to prevent encephalopathies, neuropathies, and other

frank medical conditions, but also to prevent more subtle effects such as impairment of mental development, decreased learning ability, and subclinical interference with enzyme systems of the body. Sequelae that may appear many years after exposure must be prevented. Thus, enactment of legislation controlling all sources of lead hazard as rapidly as possible is strongly recommended.

BOARD BILL NO. _____ INTRODUCED BY*

STATEMENT OF POLICY

An ordinance enacting a Lead Poisoning Ordinance which states its purpose; defines its terms; prohibits the use or application of lead-based substances in or upon exposed surfaces, fixtures, or other household described objects, or on toys or furniture; prohibits the manufacture or sale of certain articles containing lead-based substances; prohibits the manufacture or sale of lead-based substances except in a secure container that bears a prescribed warning label; provides for payment of blood-lead determinations from public funds by qualified laboratories and requires notification and registration of blood-lead measurements where laboratory determinations are performed at public expense; requires physicians, nurses, and public health officers to report diagnosed or suspected cases of lead poisoning; prohibits the burning of lead and lead-impregnated substances and controls sale and disposal of such materials in a manner consistent with the safety and health of the public; prohibits the marketing and sale of foodstuff contaminated with lead; establishes zoning restrictions to protect against lead-containing emissions in residential areas; establishes housing, health and maintenance, and occupancy standards;

* A proposed bill prepared by Alderman Stolar of St. Louis, Missouri and APHA-PHS Recommended Housing Maintenance and Occupancy Ordinance were reference sources for the preparation of portions of this material.

authorizes and directs the Building Commissioner and the Health Commissioner to inspect for lead-based substances; provides for notice to interested and affected persons of the presence of lead-based substances in or upon exposed surfaces, and provides for violations in and condemnation for human occupancy of dwellings in which, fourteen days after said notice, said lead-based substances have not been removed, replaced, or securely and permanently covered; provides for the manner of removal of paint, putty, plaster, and other structural materials; establishes Housing Courts; authorizes and directs the Health Commissioner to conduct a program to detect, treat, and prevent lead poisoning; prohibits eviction of families with children from dwelling units following enforcement of maintenance and occupancy standards with respect to lead and other health hazards; provides for limiting the expenditure of welfare housing funds to dwellings complying with all conditions required to eliminate lead hazards within dwellings or premises of dwellings; provides for enforcement, penalties, appeals, and severability; provides that this Ordinance shall not be interpreted or applied to defeat or impair rights of action for violation of this Ordinance; provides for the enforcement of this Ordinance; provides for appeals under this Ordinance; contains a severability clause; provides that section titles are not to be considered in the interpretation of this Ordinance; and contains a penalty clause.

BE IT ORDAINED BY THE CITY OF _____ AS FOLLOWS:

Section One

Title

This Ordinance shall be known and may be cited and referred to as the "Lead Poisoning Ordinance".

Section Two

Purpose

The purpose of this Ordinance is to detect and control sources of lead intake among children, which intake through ingestion and inhalation constitutes a serious health hazard.

Section Three

Definitions

For the purpose of this Ordinance, the following words, terms, and phrases shall have the following respective meanings, unless otherwise specifically provided:

(A) "Building Commissioner"--shall mean the Building Commissioner of the City of _____ or his duly authorized delegate or representative;

(B) "Health Commissioner"--shall mean the Health Commissioner of the City of _____ or his duly authorized delegate or representative;

(C) "appropriate authority"--shall mean that person within the governmental structure of the corporate unit charged with administration of the appropriate code;

(D) "dwelling"--shall mean a structure all or part of which is designed for human habitation;

(E) "dwelling unit"--shall mean any room, group of rooms, or other interior area of a structure designed or used for human habitation;

(F) "exposed surface"--shall mean in or upon a dwelling or dwelling unit, an exterior surface that is readily accessible to children, and any interior surface;

(G) "surface"--shall mean the outermost layer or superficial area of a dwelling or dwelling unit, including--but not limited to--the outermost layer or superficial area of the walls, ceilings, floors, stairs, windows, window sills, window frames, window sashes, doors, door frames, baseboards, and woodwork of a dwelling or dwelling unit;

(H) "refuse"--shall mean all putrescible and nonputrescible solids (except body wastes), including garbage, rubbish, and dead animals;

(I) "rubbish"--shall mean nonputrescible solid wastes (excluding ashes) consisting of either:

(1) combustible wastes, such as old batteries, paint scrapings, paper, cardboard, plastic containers, yard clippings, and wood; or

(2) noncombustible wastes, such as tin cans, glass, and crockery.

(J) "safety"--shall mean the condition of being free from danger and hazards that may cause accidents or disease;

(K) "owner"--shall mean any person who alone, jointly, or severally with others,

(1) shall have legal title to any premise, dwelling, or dwelling unit, with or without accompanying actual possession thereof, or

(2) shall have charge, care, or control of any premise, dwelling, or dwelling unit as owner or agent of the owner, or an executor, administrator, trustee, or guardian of the estate of the owner;

(L) "occupant"--shall mean any person over 1 year of age who is living, sleeping, cooking, eating in, or actually having possession of a dwelling unit or a rooming unit, except that in dwelling units a guest will not be considered an occupant.

Section Four

Prohibition Upon Use of Lead-Containing Substances*

No person shall use or apply substances containing lead

(A) in or upon any exposed surface of any dwelling or dwelling unit; or

* The addition of this particular section to a housing code would in most cases be adequate to give that code the needed strength in lead control.

(B) in or upon any fixtures or other objects used, installed, or located in or upon any exposed surface of any dwelling or dwelling unit, or intended to be so used, installed, or located; or

(C) in or upon any toys or furniture.

Section Five

Prohibition upon Manufacture and Sale of Articles with Lead-Based Substances

No person shall manufacture, sell, or hold for sale any of the following articles that have or contain lead-based substances:

(A) any fixtures or other objects intended to be used, installed, or located in or upon any exposed surface of any dwelling or dwelling unit;

(B) any toys or furniture;

(C) any food containers or cooking, eating, and drinking utensils and tableware with extractable or leachable lead.

Section Six

Warning Labels

No person shall manufacture, sell, or hold for sale any lead-containing substance for household or nonhousehold use--including but not limited to paint, dyes, pesticides, cosmetics, and agricultural materials--unless said lead-based substance is in a secure container bearing a conspicuous label on which appears the following statement in large and prominent letters:

"WARNING: CONTAINS LEAD.
POISONOUS IF EATEN. KEEP OUT
OF THE REACH OF CHILDREN."

Section Seven

Disposal of Lead-Containing Materials

Disposal of lead-containing materials, their ashes, and other refuse shall comply with procedures established by the Commissioner of Health or other principal health officer. The sale or giving away of such materials including--but not limited to--batteries, battery cases, and wood painted with lead-based paint is prohibited.

Section Eight

Protection of Children and Others from Dangerous Emissions

Residential zoning shall be established in such a manner as to provide protection against lead-containing emissions of exhaust products, and industrial emissions.

Section Nine

Marketing and Sale of Foodstuff Contaminated with Lead

No person shall offer for sale or distribution any foodstuff or articles contaminated with lead that will endanger the health, safety, and welfare of the person.

Section Ten

Payment of Public Funds for Blood-Lead Determinations

The expenditure of municipal (or County or State) funds are authorized for payment of blood-lead determinations in children (and in adults where warranted) by a qualified, analytical chemical laboratory certified by appropriate authorities.

Section Eleven

Maintenance of a Blood-Lead Register

Blood-lead determinations performed by an official chemical laboratory and paid for by public funds shall be reported to the Commissioner of Public Health or other principal health officer. The name, age, sex, address, date, blood-lead level of the child, and social security number of parents shall be registered and kept in public health files.

Section Twelve

Reports

Every physician, nurse, or public health officer who diagnoses or suspects the existence of lead poisoning in any person shall immediately notify in writing the Health Commissioner of such fact. Notification shall include name and age of the child, name of parents (or employer if person is an adult), present address and all addresses of such persons for the preceding 3 years.

Section Thirteen

Inspections

(A) The Building Commissioner or the Health Commissioner may, upon his own motion, inspect dwellings and dwelling units for the purpose of ascertaining the presence of lead-based substances in or upon exposed surfaces.

(B) The Health Commissioner shall immediately inspect for the presence of lead-based substances in or upon exposed surfaces of every dwelling or dwelling unit whose address appears in a report filed pursuant to Section Seven of this Ordinance.

(C) In every inspection of a dwelling or dwelling unit conducted by the Building Commissioner or the Health Commissioner (irrespective of whether such inspection is routine, upon a complaint of any nature, pursuant to paragraph ____of this Section, upon his own motion, or otherwise), he shall inspect for the presence of lead-based substances in or upon exposed surfaces and may remove samples necessary for laboratory analysis.

Section Fourteen

Notice, Violation, and Condemnation

Upon a determination by the Building Commissioner or the Health Commissioner that there are lead-containing substances in or upon any exposed surface of any dwelling or dwelling unit, he shall immediately give notice in writing thereof to all occupants, the record owner, the record mortgagees, and any known managing or rental agent of said dwelling, and shall immediately post a copy of said notice upon said dwelling in four conspicuous places.

Section Fifteen

Enforcement

The enforcement of this Ordinance shall be governed by the enforcement provisions of the Minimum Housing Standards _____ _____ (as now or hereafter in force),

the provisions of which on the date of the enactment of this Ordinance, are contained in Chapter _____of the Revised Code of the City of _____, _____, except that, for
(date)
the purposes of this Ordinance, all references in said provisions to said Minimum Housing Standards Law shall be read and construed as references to this Ordinance.

Alternative

The (administering agency) shall enforce and administer the Ordinance and the rules, regulations, and orders promulgated and issued under (this) _____act. The agency shall have authority to hold hearings in accordance with the _____ Administrative Procedure Act.

Section Sixteen

Establish Housing Courts

The (authorizing agency) is authorized and directed to establish a special court or courts whose duties shall be to expeditiously adjudicate cases involving violations of Health and Housing Codes including those involving lead poisoning, maintenance of hazardous lead exposures and other unsanitary and hazardous housing conditions. The court shall also serve as referee in cases of nuisance, promise to repair, and other complaints brought against the landlord or owner by the (appropriate agency), or occupants at risk.

Section Seventeen

Abandonment of Building

The demolition of a dwelling found to be unsafe for habitation because of lead or other hazard shall be accomplished at the expense of the owner.

Section Eighteen

Prohibition of Eviction of Occupants with Children

No person found to be in violation of the Health (Sanitary) Code shall evict, or cause to be evicted, occupants with children for the purpose of avoiding corrective maintenance ordered by court or appropriate authority to eliminate hazardous lead exposures or other unsanitary condition. Further, the families with children should be permitted to continue their occupancy in accordance with their lease or rental agreement executed prior to corrective maintenance.

Section Nineteen

Use of Public Funds for Emergency Housing

Expenditure of public welfare funds for emergency housing, foster homes, day nurseries, etc., that have lead-based paint on interior structure or furnishings is prohibited.

Section Twenty

Appeals

Appeals under this Ordinance shall be governed by the appeals provisions of the Minimum Housing Standards Law of the City of _____ (as now or hereafter in force),

which provisions on the date of the enactment of this Ordinance are contained in Chapter _____ of the Revised Code of _____ _____, except that for purposes of this Ordinance, all references in said provisions to said Minimum Housing Standards Law shall be read and construed as references to this Ordinance.

Section Twenty-One

Severability

The sections of this Ordinance are severable. In the event any section of this Ordinance is found by a court of competent jurisdiction to be unconstitutional, the remaining section of this Ordinance are valid, unless the Court finds that the valid sections of this Ordinance are so essentially and inseparably connected with, and so dependent upon the void section, that it cannot be presumed that the valid sections would have been enacted without the void one, or unless the Court finds that the valid sections, standing alone, are incomplete and are incapable of being executed in accordance with the legislative intent.

PART VI

FISCAL MEANS FOR SUPPORTING A LEAD CONTROL PROGRAM

In the table that follows, this guideline provides information about potential sources of Federal funds that can conceivably be used to support programs directed at controlling lead poisoning among children. The term "potential sources" cannot be stressed enough in its literal meaning, for that is precisely the status of those funding programs listed in Table I as they presently* relate to lead control activities.

In none of these programs are there specific allocations of monies for medical casefinding or treatment in connection with lead poisoning control, nor are there any for environmental deleading. Unavoidably, too little is known at any given time about the funding levels in each program because they fluctuate continually.

However, it is recommended that the status of funding from these potential sources be reviewed at the planning stage of the program.

Although lead poisoning of children is identified primarily as an urban problem, funding sources that are specific for rural areas and special population groups are also included in this compilation. The rationale for this is to anticipate the possibility that similar lead poisoning problems in rural areas or among migrant workers might become more obvious in the near future

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*Refers to Fiscal "71

than they are today. In addition, programs for rural areas might, in fact, be applicable to political jurisdictions that are not usually considered rural under casual observance. An incorporated municipality of less than 5,500 population, and which becomes part of a metropolitan suburb while maintaining its political independence, could conceivably qualify as a rural area, technically. Because of its proximity to a metroarea it can easily be classed as part of a neighboring city, although it does have the same problems as other rural areas and is, in fact, an independent political jurisdiction.

Without equivocation, program planners are urged to make use of available technical assistance and consultation from the respective Regional offices of the various departments named in this guideline. This should be done before any firm planning steps are taken so as to avoid unnecessary loss of time and effort. Technical aid may well be the main, though not the only, Federal contribution to local lead control programs available at this time.

Program planners should also be aware that there may be as yet untapped local or State funding sources. Principally these could come from consolidation, and shifting of funds and personnel from existing programs that have lost their major thrust or are of lesser relative importance. These sources will naturally have to be determined locally because of the number and variety of local potential resources and because the complex conditions that govern their availability cannot be second-guessed at the Federal level.

TABLE 1. POTENTIAL FEDERAL SOURCES FOR FISCAL SUPPORT

Administering agency: Farmers Home Administration
U. S. Department of Agriculture
Washington, D. C. 20250

Program Title:

1. Farm Labor Housing

Nature of program	Provides insured loans to finance construction, improvement, and repair of rental housing for domestic farm laborers.
Eligible applicants	State or political subdivisions or other public bodies.
Requirements	Applicants must be unable to finance improvements with their own resources or with credit from other sources; must have security for loan and must repay loan; must maintain and operate the housing financed with the loan or grant.
Relation to lead program	Potential source of financial assistance for rural landlords for removal or control of lead sources in the home environment of migrant workers.

2. Rental and Cooperative Housing for Rural People

Nature of program	Provides loans for rental and cooperative housing in rural areas for low-income and moderate-income families. Loans can be used to construct, purchase, improve, or repair rental or cooperative housing.
Eligible applicants	Individuals, business corporations, nonprofit corporations, and cooperatives are eligible.
Requirements	Applicants must be unable to finance the housing with their own resources or with credit obtained from private sources. Applicants must be able to assume obligations of the loan, furnish adequate security, and have sufficient income for repayment. Applicant must also have the intention and ability for maintaining and operating the housing for the purposes for which the loan is made.

Relation to lead program	Potential source of financial assistance for rural landlords and cooperatives to remove or control the sources of lead in the rural home environment.

3. Rural Housing Loans

Nature of program	Provides loans for construction, improvement, and repair of rural homes, farm service buildings, and related facilities.
Eligible applicants	Low and moderate income farmers and residents of rural areas; and communities with populations up to 5,500.
Requirements	Applicants must be unable to finance improvements themselves and be unable to obtain reasonable credit terms elsewhere; must be United States citizens, or planning to become citizens of the United States, of legal age and good reputation; must lack decent, safe, and sanitary housing or essential farm service buildings.
Relation to lead program	Potential source of financial assistance for farm or rural nonfarm homeowners for removal or control of lead sources in home environment.
Other	For low-income families, there are special supplemental provisions for payment of interest so that interest rates can be reduced to 1 percent.

Administering agency: Federal Housing Administration
Department of Housing and Urban Development
Washington, D. C. 20410

or

Local FHA Insuring Office

Program Title:

1. Title I Home Improvement Loans

Nature of program	Provides for insurance of loans up to $5,000 to alter, repair, and improve residential and non-residential properties, and loans up to $15,000 (not to exceed $2,500 for each dwelling) to alter, repair, improve or convert existing structures used, or to be used, as dwellings for two or more families.
Eligible applicants	A person who either owns the property to be improved, is buying it under contract, or holds it under a lease good for 6 months beyond the date the loan will mature.
Requirements	Loan term is 7 years, or not over 12 years from the date the original loan was made if the note is refinanced. Loans may not be used to pay for work already done. These loans are handled directly by FHA approved lending institutions, and prior credit approval by the FHA is required only for loans exceeding $5,000.
Relation to lead program	Potential source of financial assistance for homeowners and landlords to make needed improvements to remove or control lead sources in the home environment.
Other	No downpayment is required, and in most cases the borrower's signature serves as security so that no co-signer is required. Application for the loan is made to any commercial lender participating in the FHA loan-insurance program. Under the Title I improvement loan program, the FHA insures private lending institutions against loss. The FHA does not make any direct loans.

Program Title:

2. Code Enforcement Grants

Nature of program	Provides financial assistance to carry out 3-year concentrated code-enforcement projects in appropriately selected areas. Grants are provided for up to two-thirds of the eligible costs - three-fourths for communities of 50,000 or less in population - for the planning and execution of the code-enforcement program. In addition, financial assistance in the form of direct 3-percent-interest loans and grants up to $3,000 are available to eligible area residents. All eligible relocation costs for persons displaced as a result of the code enforcement are provided.
Eligible applicants	Cities, counties, and other municipalities with statutory authority to enforce a comprehensive system of codes regulating the use and construction of private properties within the community.
Requirements	Applicant communities must have a certified Workable Program for Community Improvement in effect; must be carrying out an effective program of code enforcement; agree to maintain normal levels of expenditures for code enforcement, exclusive of that required for the project area; agree to provide relocation assistance to all those displaced by project activities; provide at local expense all those public facilities necessary to accomplish the purpose of the program but that are not eligible project costs.
Relation to lead program	It is possible for activities relating to identification, (including sampling and testing), of lead sources in the home environment to become an eligible cost item in a comprehensive code-enforcement program. Accessibility of lead paint to children will have to be identified in the code as a violation. Property owners who are not able to meet the costs of removing the paint or otherwise making it inaccessible to children can be eligible for a direct low-interest loan or grant to help bring the property up to the standards of the code.
Other	(Please refer to the note at the bottom of page VI-8).

Program Title:

3. Housing Rehabilitation Loans

Nature of program	Provides loans to assist rehabilitation in existing and in future urban renewal and code enforcement areas as certified by the locality. Intention of the program is to reduce the need for demolition and removal of structures by financing rehabilitation required to make the property conform to applicable code requirements; to carry out the objectives of the plan for the area; and, in addition, to make certain other improvements. The maximum loan for residential housing would be the amount that could be insured under Section 220(h) of the National Housing Act.
Eligible applicants	Owners of property in urban-renewal or concentrated code-enforcement areas. With some exceptions, loans on residential properties are limited to applicants whose incomes are within the maximums prescribed by the Secretary, Department of Housing and Urban Development, under Section 221(d)(3) of the National Housing Act. Loans are made through the public agencies administering the local program.
Requirements	Those prescribed by the loan program. For specific information, refer to the lending agency or Regional Office of the Department of Housing and Urban Development (HUD).
Relation to lead program	Similar to that specified in 2 - Code Enforcement Grants.
Other	(Please refer to the note at the bottom of page VI-8).

4. Housing Rehabilitation Grants

Nature of program	Provides grants to individuals or families who own and occupy residences in neighborhood-development, urban-renewal, and code-enforcement areas and in areas certified by the locality to become such areas. Grants cover the cost of repairs and improvements necessary to make the property conform to applicable codes or other requirements of the plan for the area.
Eligible applicants	Owner-occupants of one-to-four-dwelling-unit properties located in federally-assisted-project areas.

Requirements	Those imposed by the grants program. For specific information, public agency administering the local program or to the HUD Regional Office.
Relation to lead program	Similar to that specified in 2 - Code Enforcement Grants.
Other	(Please refer to note at the bottom of this page).

5. Interim Assistance for Blighted Areas

Nature of program	Provides grants to localities for interim assistance programs in slum and blighted areas that are planned for major renewal involving substantial clearance in the near future. Grants are for planning and carrying out activities in these areas to alleviate harmful conditions for which some immediate public action is required until permanent action can be taken.
Eligible applicants	Cities, other municipalities, and counties.
Requirements	Locality must have currently certified Workable Program for Community Improvement.
Relation to lead program	Provides a potential source for funding activities to remove or otherwise make lead sources in the home environment inaccessible to children. Improvement activity within dwelling units would probably be limited under this program to buildings that are owned by the municipality. In this event, other funding mechanisms could probably be employed to assist with improvements in buildings that are privately owned.
Note	These funding mechanisms will not provide funds exclusively for a lead program. Lead control activities will have to be incorporated into the broader code-enforcement or urban renewal program. In most cases, a major upgrading of buildings will be required with the result that improvements under these programs would require expenditures that are substantially above those that would be adequate for lead control alone.

Administering agency: Maternal and Child Health Service
Health Services and Mental Health Administration
U. S. Department of Health, Education and Welfare
Washington, D. C.

or

State Health Agency

Program Title:

1. Maternal and Child Health Services Improvement

Nature of program	Provides grants-in-aid to States to extend and improve services for reducing infant mortality and promoting the health of mothers and children. Services include, among others, well-child clinics and visits by public health nurses. Grants also are made for special projects of national or regional significance that may contribute to the advancement of services for maternal and child health.
Eligible applicants	States, for grants for maternal and child health services; State health agencies and institutions of higher learning for special project grants.
Requirements	Special emphasis on rural areas or areas suffering from severe economic distress; State allocation figured by forumla; State must match, on dollar-for-dollar basis, one-half of the Federal funds.
Relation to lead program	Program is a potential source for financial assistance in screening, clinic services, and visiting-nurse services for medical aspects of a lead program when operated in conjunction with ongoing maternal and child health programs.

2. Comprehensive Health Care Projects for Children and Youth

Nature of program	This program provides financial support for health care and services to children of school and pre-school age, particularly in areas with concentrations of low-income families. The program includes medical screening, diagnosis and preventive services. Treatment, correction of defect, and aftercare services are provided to children who would not otherwise receive them because of low-income or other reasons beyond their control.

Eligible applicants	State and local health departments, State crippled children's agencies, and medical schools and hospitals (affiliated with schools of medicine) are eligible for grants.
Requirements	Agencies applying for grants must be prepared to offer comprehensive health services to children of low-income families in the proposed project area. They must submit an application which shows the scope and methods of project operations and shows the source of required matching funds.
Relation to lead program	Program offers a potential source for medical screening, diagnosis, and treatment services for lead control programs conducted in areas with concentrations of low-income families.

Administering agency: Community Health Service
Health Services and Mental Health Administration
U. S. Department of Health, Education and Welfare
Washington, D. C.

Program title:

1. Health Services for Migratory Workers

Nature of program	Projects assisted under this activity provide health services to migrant agricultural laborers and their families. The purpose of this program is to raise the level of migrants' health to that of the general population. The grants may be used to help support a wide range of health services: medical, nursing, dental, health education, hospitalization, and sanitation services. The major emphasis of the program is to assure that migrants have access to ongoing community health services provided in ways adapted to their situation and need.
Eligible applicants	State and local health departments and other agencies; nonprofit private agencies, institutions or organizations; are eligible to apply for grants under this program.
Requirements	The grantee pays a part of the cost which varies from project to project depending upon the relationship between the magnitude of the problem and other available resources. This share may be paid in money, or contributions of equipment, supplies, personal services, facilities, or other essential items.
Relation to lead program	Potential source of financial assistance for screening and medical care for children of migrant workers affected by lead, and for removal or control of lead sources in the home environment through sanitation improvements.

2. Comprehensive Public Health Services

Nature of program	Provides grants to the States for support, development, and expansion of public health services to meet the needs of their citizens in accordance with priorities and goals established by the States. Encourages the States to develop coordinated programs of State and local public health services, including those directed at maintaining physical and mental health, detecting, preventing, and controlling disease, injuries, and disabilities; and protecting and maintaining a healthful environment.

Eligible applicants	All state health and mental health authorities are eligible to receive an allotment under section 314(d) of the Public Health Service Act, as amended by Public Law 89-749 and Public Law 90-174. United States' territories are also eligible.
Requirements	States are required to submit a State plan for provision of public health and mental health services to be supported in part by funds provided under section 314(d) and which contain the information and meet the requirements specified in subsection 314(d)(2) of the Public Health Service Act and in the regulations.
Relation to lead program	Potential source for funds that can be used to establish and operate State and local lead-control programs that include casefinding, medical care, neighborhood identification, and deleading operations.

3. Health Services Development

Nature of program	Provides grants to public and private nonprofit agencies and organizations to cover part of the cost of providing services, including related training to meet health needs of limited geographic scope or of specialized regional or national significance; developing and supporting, for an initial period, new programs of health services, including related training. (PL 89-749, PL 90-174, 314(e).
Eligible applicants	Public and private nonprofit agencies and organizations.
Requirements	Federal share must be less than 100 percent. Projects must be in accord with State plan for comprehensive health services. Funding priority will be given to projects of a comprehensive nature or that contribute to comprehensive care for indigent individuals and their families.
Relation to lead program	Potential source of financial assistance for establishing and operating local comprehensive lead-control programs.

PART VII

PROCEDURAL GUIDE FOR IDENTIFICATION AND MANAGEMENT OF ENVIRONMENTAL LEAD HAZARDS IN THE RESIDENTIAL ENVIRONMENT

A three-phase approach to the identification and management of lead hazards is recommended, combining environmental appraisal and medical screening techniques. The approach is to (1) identify potentially hazardous neighborhoods through published Bureau of the Census data; (2) assemble descriptive baseline data to help define magnitude of the problem by sample survey of selected potential high risk areas, and (3) help plan and execute a control program stressing environmental control methodologies, intensive medical screening, and referral of children with high blood lead levels for treatment.

PHASE I - ENVIRONMENTAL EVALUATION BY USE OF EXISTING CENSUS DATA

Bureau of the Census data provides an easily accessible source of information that can be used to conduct a relatively simple, cursory appraisal of community environmental quality as it relates to lead poisoning. By considering environmental conditions and age factors usually associated with lead poisoning among children, census tracts can be ranked according to the likelihood of the occurrence of lead poisoning. The ranking technique should aid program managers in determining the potential magnitude of the problem, designing a control program, assigning work area priorities, and allocating resources.

APPRAISAL FACTORS

Houses that were built prior to World War II are generally considered to have paint with high lead content on their walls, ceilings, windowsills, doors, and doorjambs, as well as on other surfaces. Sometime earlier other substances began to replace lead in the manufacture of most interior paints. The poisoning hazard is increased where painted surfaces are deteriorating, making leaded paint more accessible to children who occupy the premises, through chipping, peeling, and flaking from the surface.

In the appraisal system recommended here, three factors are used for a scoring technique by which to rank census tracts according to their relative conduciveness to the occurrence of lead poisoning in children:

1. Age of the structure;
2. Deterioration of the structure;
3. Occupancy by children in the susceptible age category--between one and six years of age.

This system is especially designed to be as uncomplicated as possible to facilitate rapidity and ease of use and to accomodate trainee paraprofessionals and other employees who are unfamiliar with data and numerical manipulations.

A somewhat more sophisticated technique has also been developed and is included in Appendix I of this section. It is not recommended here as the primary appraisal methodology because it has not been

strongly tested. The Bureau of Community Environmental Management would hope to see it used by interested cities and would appreciate receiving information regarding the results of such tests.

DATA TABULATION

Use of data tabulation sheets similar to those accompanying this guideline section is suggested. Data from the 1970 census should be used. Data from the 1960 census could be used as information only on the environmental factors of age of structure and deterioration of housing units. Population characteristics have probably changed so radically (in the areas of cities that will be of chief concern) as to make the 1960 data grossly inaccurate.

If the population data for a city have been periodically updated since 1960, or if other population data of reasonable accuracy is available from other sources, this can be used in combination with the 1960 data. If 1960 data alone must be used, it is recommended that census tracts be ranked by using age of structure and deterioration of housing unit data only. In this instance, a study of the population age characteristics should be made, prior to the initiation of lead control activities, in those census tracts showing a high probability of lead poisoning as determined by the environmental factors. This will add the third necessary dimension to the 1960 data.

As an aid to clarifying the instructions that follow in the use of WORK SHEET A and WORK SHEET B, data entries of an actual

census tract are included in the sample WORK SHEET A. Copies of the worksheets will be found in APPENDIX II.

USING WORK SHEET A

Census tract numbers are entered in the column at the extreme left side of the form. The total number of housing units in the census tract (1) can be taken directly from Table H-1 of the census data. (Tables from the 1960 census are used here as examples since format samples of the 1970 census tables are not as yet available). Figure 1 (in Appendix II) shows the location of the data in the table for census tract P-001 of a sample city.

The number of Housing Units Built Before 1950 (2) as a percentage of all housing units can be determined by the simple formula shown on WORK SHEET A. This information is also taken from Table H-1. The number of structures built between 1940 and 1949 are added to those built in 1939 or earlier. This sum is mutiplied by 100, in the formula, to avoid working with numerical decimals. The product is divided by the total number of housing units to derive the percentage:

93 + 904 = 997 Housing Units Built Before 1950

$$\frac{\text{\# HU} \times 100}{\text{TTL HU}} = ____\%$$ Substituting,

$$\frac{997 \times 100}{1001} =$$

$$\frac{99,700}{1001} = 99\%$$

Similar computations are made for determining the percentage of Deteriorated Housing Units as a function of the total number of units in the census tract. Here dilapidation is considered as extreme form of deterioration and, as shown in (3) Figure 1, the number of units in each category are added together:

$$225 + 11 = 236$$

The formula is completed as follows:

$$\frac{\#\ HU \times 100}{TTL\ HU} = ____\%\ \text{Substituting,}$$

$$\frac{236 \times 100}{1001} =$$

$$\frac{23,600}{1001} = 24\%$$

Total population for the census tract (4) is taken from column tract P-001 in Figure 2 (in Appendix II). Since separate figures for male and female are given, they must be summed. In our example this would be:

$$1521 + 1660 = 3181 - \text{Total Population}$$

The formula for determining the number of children under 6 years of age as a percentage of the total census tract population is the same as in (2) and (3). Referring again to Figure 2, the numbers of males and females in each of the age categories from 1 through 6 years of age (5) are combined and the sums added together:

Male		Female	
46		38	
37		42	
30		38	
34		44	
43		20	
33		34	
30		27	
253	+	243	= 496 children under 6

Completing the formula,

$$\frac{\text{\# Child. X 100}}{\text{TTL Population}} = ____\%$$

$$\frac{496 \text{ X } 100}{3181} =$$

$$\frac{49,600}{3181} = 15\%$$

Determining the potential hazard score for the census tract (6) is accomplished by simply summing the figures in columns (2), (3), and (5) as follows from the example:

$$99 + 24 + 15 = 138$$

WORK SHEET B

This form merely provides a means for tabulating census tracts by rank as determined by their respective scores. The tract with the highest score is ranked Number 01 and the tract with the lowest score is given the lowest place in the ranking scale. The scale will help establish priorities for the lead control program activities.

PHASE II - STATISTICAL SAMPLE TO VALIDATE POTENTIAL RISK SITUATION

The preventative aspects of the problem - removal of the hazard from the environment - present significant economic implications. It is necessary to validate the results obtained from Phase I - determination whether a low, moderate, or high risk hazard potential exists - and assemble baseline data upon which a control program can be developed. This is done by statistically sampling for (1) the presence of lead in the dwelling and (2) blood-lead determination in children as shown below.

PHASE III - SATURATION CONTROL PROGRAM

After neighborhoods with high lead concentrations and childhood poisoning problems have been identified, the city can move ahead with a saturation control program in these areas. This will be an expensive undertaking and all potential resources should be carefully identified and studied to determine their actual availability and applicability.

A saturation control program for these areas would involve 100% medical screening of children within the susceptible age group, referral for treatment of positive cases, an environmental appraisal of the entire neighborhood and dwelling units, and environmental deleading. Medical procedures are discussed in other sections of this guideline and need not be considered here.

There are two major areas of importance for environmental control. Of primary importance are sources within dwelling units, and their premises. Those of secondary importance are environmental sources outside the home environment and those that cannot be altered by immediate practical solutions. Most programs will probably place the greatest emphasis on controlling primary hazardous sources and include control of secondary sources as part of continuing future operations. These later operations will obviously require long range cooperative planning with other major agencies since they are part of the larger environmental pollution problem.

A. ENVIRONMENTAL APPRAISAL

Cities that have studied the problem of childhood lead poisoning have found that most of the children diagnosed as having clinical lead intoxication were found to have been eating paint or lead-containing plaster. Sources of lead-containing paint available to children on the walls, ceiling, doors, railings, and window sills of dwelling structures should be given primary consideration in the control program. Although present day interior paints contain 1 percent or less of lead pigment, peeling and chipping of underlying layers of older paint containing higher percentages of lead present the major hazard. Some types of exterior dwelling paint continue to employ a lead base; therefore, exposure to leaded exterior surfaces continues to present a potential danger to children.

Method of Testing for Leaded Paints

1. Chemical Analysis

The most commonly used method for determining lead content in samples of applied paint at the present time is through chemical analysis of collected samples. Several techniques have been developed. Some require laboratory facilities and others can be done in the field by trained personnel.

In regard to the latter, Kaplan[1] describes a simple wet-chemical method that can be done in the field. In principle, a 25-mg sample of paint scrapings is weighed on a simply constructed

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[1] Kaplan E., and Shaull R., "Determination of Lead in Paint Scrapings as an Aid in the Control of Lead Paint Poisoning in Young Children," AJPH, Vol. 51, No. 7, January 1961.

field balance and digested with nitric acid solution to extract lead. Water and sodium sulfite are added, extraneous material is removed by centrifuging, and potassium iodide added to precipitate the lead as lead iodide. Conditions are empirically adjusted so that more than 1 percent of lead is required for a positive test. The 25-mg balance is made from a section of plain white index cards glued to a piece of one-quarter inch square hobby shop balsa wood.

2. X-ray Spectrometry Analysis

X-ray spectrometry techniques have been developed which greatly reduce the time required to determine the lead content of painted surfaces.

Several portable instruments which use the principle of radioisotope x-ray fluorescence (X-R-F) analysis are now commercially available. These instruments can determine the amount of lead in a given area of a painted surface no matter how many coats of paint are there. Analysis of painted surfaces with these instruments can be done quickly. This is a non-destructive technique and eliminates the need for gathering numerous paint samples. This type of instrument could be very useful if mass screening of dwellings is to be done.

B. IDENTIFICATION AND EVALUATION OF SECONDARY LEAD SOURCES

Although ingestion of leaded paint has been identified as the prime means of lead intake among children, some consideration should be given at later stages in the program to evaluating the role of secondary sources. Some potential sources of secondary

lead intake have been identified, but the magnitude of their effect has yet to be confirmed. These are discussed briefly below:

1. Lead intake through drinking water delivered through lead pipes or stored in lead-containing tanks (contained in the metal of the tank, lead soldering of joints, etc.) has been considered as a hazard but this remains questionable. A study by the New York City Health Department indicated that 2.5% of all tap water samples tested had a significant lead content.

2. Another potential contamination source is related to the use of kindling in home space heaters. In neighborhoods in which casings from lead storage batteries or other combustible materials which have some lead content are available and are used for kindling, there is a danger of inhalation of leaded fumes where heaters are improperly vented. The same problem exists in using leaded kindling wood taken from old buildings. If these materials are used on a large scale throughout the neighborhood, lead from this source could affect the entire neighborhood. Disposal of ashes also becomes a problem in that children can ingest lead by playing in ash piles.

3. Cases have been reported of lead intake from eating frost and ice from inside refrigerators or freezers and also from drinking water which collects in drip pans. The extensiveness of this problem has yet to be determined.

4. Atmospheric lead contamination from industrial pollution and motor vehicle exhaust are additional sources of lead contamination in the neighborhood, and their role in the childhood lead poisoning problem needs to be given greater specificity.

C. ALTERNATIVES FOR REMOVING PRIMARY LEAD SOURCES

The following alternatives for controlling primary lead sources are offered for consideration in the development of lead control programs. Establishment of program priorities, implementation methodologies, and estimation of cost factors should be determined locally since they will be affected by local conditions.

Immediate Temporary Solutions

Once a dwelling has been found to have significant concentrations of lead, several approaches to interfere with the child-lead interaction can be considered.

1. Relocation of the family to lead-free quarters.
2. Use of lead-free playrooms if home supervision is inadequate.
3. Immediate improvement of home environment through education of parents on the lead problem as it relates to children.

Shielding of Leaded Surfaces

The intention in the use of this method is to isolate the lead-loaded wall from the child. The ideal materials should have the following properties:

1. Difficult to scrape or puncture

2. Vermin proof

3. Fire resistant with a high ignition temperature

4. Do not release noxious vapors at high temperatures

5. Should not place additional stress on the existing structures of the building.

6. Reasonable installation costs (labor and materials)

7. Low maintenance cost

Suitable materials are presently available but consideration must be given to cost of materials, and whether application techniques require skilled labor or whether installations can be made by tenants or neighborhood groups. It would be preferable if these applications could be by the tenants themselves.

1. Flat Surface-Covering Material

a. Gypsum Board. The installation of this material creates a new wall in front of the old. It costs about 5 cents per square foot for materials. Installation is relatively expensive and sophisticated, requiring skilled labor at a probable total cost of 40 to 50 cents per square foot.

b. Fiberglass Wall Covering Materials. Loose paint and plaster must be removed prior to application and some patching of the wall may be necessary. It is supplied in 40-inch wide sheets; an adhesive compound is applied with a roller over the sheets.

Cost for materials is 10 cents per square foot. In some buildings, with two coats of paint over it, this has lasted very well for 10 years. The cost of complete application by contractors ranges from 50 to 60 cents per square foot, possibly higher--depending upon preparatory work required.

c. Paper Wall Cover Materials. These can be made strong, fire-retardant, and attractive, and can be applied on an unsound wall in a horizontal fashion. The cost of materials run about one cent per square foot.

Consideration should be given to use of heavy kraft paper (brown wrapping paper) and painting over it with several coats of lead-free paint as a quick temporary measure.

d. Vinyl Coat Sheeting. This material must be applied with an industrial adhesive. It is the least combustible of the plastics, but does give off some hydrochloric acid fumes in fire. It has very low maintenance, can be tailored to order, and has a cost (including adhesive, not labor) of 10 cents per square foot. Rigid vinyl board is available but sheeting might be preferable largely because of labor factors.

e. Plywood and Hardboard. Application of inexpensive grades of thin (¼ inch) plywood, or interior hardboard (1/8 inch) by nailing directly to the wall studs in an effective method of imposing a barrier between the child and the leaded surface. If additional finishing is required, abutment joints can be covered with wood strips or installed with ready-made metal joiners.

The entire surface can be painted with lead-free paint to add an esthetic quality. Hardboard costs about 6 cents per square foot and plywood about 10 cents per square foot. Installations can be made by tenants, landlords, or civic minded neighborhood groups.

2. Liquid Covering Materials

The general problems involved in the use of liquids include adequate strength (i.e., vinyl paints are not as strong as vinyl films), thickness control, adhesive problems with heavier films, and the general need for some wall preparation (sanding, raking, cleaning, etc).

a. Non-Leaded Paint. As an expedient measure the walls, ceiling, sills, and other surfaces can simply be scraped to remove all loose paint and plaster chips and the surfaces repainted. This might have to be repeated at relatively frequent intervals since peeling will likely continue. Routine inspections should be considered as a practical control measure. Such an approach might be considered for dwelling units in areas marked for urban renewal or for other massive changes in the near future in which large investments of resources would not be practical. This plan would imply eventual relocation of the residents.

b. Pigmented Masonry Conditioner. This is an excellent substance if flaking, peeling, and scaling paint could be removed from the underlying wall. It has a tung oil base which makes it penetrate very well. Several coats add binding strength to the wall.

3. Removal of Old Finishes

a. Common Methods. Most methods for paint removal are time consuming and costly. To offset the cost, some codes presently in effect require the removal of paint only to the height of 5 feet (within the reach of children 1 to 6 years old) and from protruding surfaces, such as windowsills, doors, etc. This appears to be a satisfactory compromise so long as there is no peeling or flaking of paint from the ceiling or surfaces above the 5-foot level. Common methods include application of paint removers, sanding, scraping, steaming, and burning with propane torches. All methods are effective to varying degrees, but all have some drawbacks. Some cities have tried the burning procedure, but it is slow and presents a fire hazard.

b. Chemical Paint Removers and Steamers in Combination. The National Paint, Varnish and Lacquer Association has developed a method which it claims that under ideal conditions will remove four to five coats of interior finishes from plaster, vinyl wall covering or wood at a rate of approximately three square feet per minute.

The method uses paint and varnish removers of the water rinseable type and accelerates the paint softening action with the application of steam. The paint remover is applied to the wall or woodwork and allowed to stand for 15 minutes. Steam is then applied through a suitable steamer pan, which is moved after a short time. The steaming action is followed by scraping with a wide blade.

In demonstrations in New York, the method was found to be faster and considered to be less hazardous than propane burning. It has been reported that Baltimore found some undesirable features associated with the method and has resorted to propane burning.

4. Uneven Surfaces

A special problem is created by the presence of unevenly shaped surfaces such as window sills, window trim, doors, molding, railings, etc. Materials such as plywood, gypsum, and fiberglass which are used to cover large wall areas cannot be readily used on these uneven types of surfaces. These uneven surfaces should be scraped down to the basewood and then repainted with non-leaded paint.

D. ALTERNATIVES FOR CONTROLLING SECONDARY LEAD SOURCES IN THE NEIGHBORHOOD ENVIRONMENT

Industrial Sources

A part of the community's neighborhood deleading program should be to identify industrial and commercial operations that can contaminate the neighborhood atmosphere. Through air sampling-with subsequent laboratory analysis, and study of industrial operations-the amount of lead being put into the atmosphere and collecting in the neighborhood should be determined. The potential effects of Pb from industrial sources in combination with other lead sources in the residential environment should be evaluated. Several obvious

solutions to serious problems arising from industrial output are:

1. Controls over industrial operation to reduce the amount of aerial lead effluent;
2. Relocation of the most hazardous operations to other sites;
3. Relocation of residents of the neighborhood to more favorable residential areas;
4. Modification of and stringent enforcement of zoning regulations to separate and buffer commercial, industrial and residential areas.

Streets, Parking Lots, and Highways as Sources

Exhaust fumes from automobiles, trucks, and other road vehicles are sources of atmospheric lead contamination. Tests should be conducted to determine concentrations of lead in residential areas. Traffic pattern studies also need to be made to determine whether residential streets have become major traffic arteries and to evaluate the effects of nearness of major highways to residential areas. Several remedial steps can be proposed:

1. Rerouting of traffic away from residential areas combined with strict enforcement of traffic regulations;
2. Revision of traffic plans and zoning regulations to keep major traffic arteries away from residential areas;
3. Relocation of residents.

PART VII

APPENDIX I

ALTERNATE METHOD FOR IDENTIFICATION AND MANAGEMENT OF ENVIRONMENTAL LEAD SOURCES IN THE RESIDENTIAL ENVIRONMENT

Bureau of Census data can be used to classify by census tracts those areas of communities having high, moderate, or low potential for lead poisoning. The categories to be used are those with specific sub-items which are known or highly suspected to be associated with the incidence of lead poisoning among children. These are listed below. Relative weights between categories and items within categories are also given. "X" indicates the weight between categories and "z" the weights between items within categories.

1. Age of structure

   x = 3

   z = 6 1939 and earlier

   z = 3 1940 - 1949

   z = 1 1950 - 1955

2. Level of structural deterioration

   x = 2

   z = 10 Dilapidated

   z = 5 Deteriorated

   z = 0 Sound

3. Number of children in census tract within most susceptible age grouping

x = 3

z = 6 1 - 3 years

z - 2 3 - 6 years

z - 1 1 year and under

4. Socially related indicators

x = 1

z = 1 Renter occupancy

z = 2 Duration of occupancy

z = 2 Income

z = 5 Crowding conditions

z = 10 Family relationships

WEIGHTING AND SCORING SYSTEM

By applying a relative weighting system between categories and between items in each category, scores can be derived for each category and for the census tract. The census tract score is compared with a scale and classified as having a high, moderate, or low risk potential. By plotting the census tracts on a map according to classification, cities will have a graphic means for determining the presence and degree of severity of potential lead poisoning hazards.

Further checks on the accuracy of the data may be obtained by cross-checking the records of health clinics, physicians, and

hospitals for actual or hearsay information about possible lead poisoning cases, and by checking housing, building inspection, or other municipal records for indicators of maintenance conditions.

PROCEDURE FOR DETERMINING POTENTIAL LEAD POISONING HAZARD FROM CENSUS DATA*

For each of the categories, the cumulative penalty score is derived for each census tract by computing the average point value for each category. This is accomplished through the following steps:

1. Multiply "x" and "z" factors (weighting points between categories and between subitems of each category, respectively) for each subitem to obtain the penalty score.
2. Multiply this number by the number of units that applies to each of the subitems.
3. Sum the totals for each subitem and divide by the total number of units in that category to obtain the Cumulative Penalty Score.
4. Sum the Cumulative Penalty Scores of all categories to obtain the Total Penalty Points for the census tract.

The potential lead poisoning hazard risk category for the census track can be determined from the following table:

High Risk	60 to 40	Moderate Risk	39 to 30	Low Risk	29 to 0

A color coding system can be developed for the penalty point score ranges - such as red for High Risk, blue for Moderate Risk,

and green for Low Risk - and plotted on a map. This will provide a graphic means for identifying the most potentially hazardous areas and help in planning for remedial action.

COMPUTATION OF CUMULATIVE PENALTY SCORE

The procedure to compute the Cumulative Penalty Score for each category is represented by the following formula. The Age of Structure category is used here as an example, but the general format of the formula applies to all categories.

$$\frac{(HU_1 \times PP_1 + HU_2 \times PP_2 + HU_3 \times PP_3)}{(HU_1 + HU_2 + HU_3)} = CT$$

Where: $HU_1 + HU_2 + HU_3$ is recorded in (1) on form.

$HU_1 \times PP_1 + HU_2 \times PP_2 + HU_3 \times PP_3$ is recorded in (3) on form.

HU_1 = structures built in 1939 or earlier

HU_2 = structures built in the period 1940 - 1949

HU_3 = structures built in the period 1950 - 1955

PP_1 = Penalty Points for subitem HU_1:

x(3) X z(6) = 18

PP_2 = Penalty Points for subitem HU_2:

x(3) X z(3) = 9

PP_3 = Penalty Points for subitem HU_3:

x(3) X z(1) = 3

The formula can be worked out using the following hypothetical values:

HU_1 = 835

HU_2 = 145

HU_3 = 275

$$\frac{(HU_1 \times PP_1 + HU_2 \times PP_2 + HU_3 \times PP_3)}{(HU_1 + HU_2 + HU_3)} = CT$$

$$\frac{(835 \times 18 + 145 \times 9 + 275 \times 3)}{(835 + 145 + 275)} =$$

$$\frac{(15,030 + 1,305 \quad 825)}{(1,255)} =$$

$\frac{17,160}{1,255}$ = 13.67 or, rounded to the nearest whole number:

Category Total = 14

RATIONALE FOR USE OF CENSUS DATA CATEGORIES

1. Age of Structures

This item indicates the probable presence and content of leaded paint in the dwelling structure. The older the structure, the higher the probability of greater numbers of coats of paint on interior surfaces, and the higher the probability of paint with a high lead content. Structures built during various time periods are assigned relative weighting points as previously indicated.

2. Level of Structural Deterioration

Peeling and chipping of paint occurs where a high degree of deterioration is present, thereby making leaded paint more accessible to children. Most clinically diagnosed cases of lead poisoning have identified ingestion of peeling leaded paint as the primary source of lead intake among children. A direct relationship exists between exterior deterioration and interior maintenance problems. Deterioration is therefore an important factor in evaluating the hazard potential of the structure.

3. Number of Children in the Census Tract Within the Most Susceptible Age Grouping

Children up to about the age of six years are considered to be susceptible to lead poisoning, with those between one and three years being the most susceptible. The association of environmental and other factors with potentially susceptible children is a highly undesirable situation and therefore an important consideration in a lead poisoning prevention program.

4. Socially Related Factors

Factors of a social or demographic nature, that are related to the problems of lead poisoning are:

a. Renter Occupancy - Such housing units are presumed to have low maintenance, frequent change of household, and a higher deterioration rate than owner-occupied housing units, and they are therefore penalized.

b. Occupancy Duration - Frequent occupancy changes result in low maintenance and high deterioration of the housing unit. A housing unit that has been occupied for one year or less is considered to have a high deterioration rate and is therefore penalized.

c. Income - Low housing-unit-maintenance and poor nutrition, which may be associated with pica among children, are presumed to be in association with low income. Therefore, families with incomes of less than $4,000 per year are given a penalty score.

d. Crowding Conditions - Overcrowding results in poor maintenance and high deterioration of dwelling units thereby increasing probability of peeling and chipping of paint. This evaluation penalizes dwelling units in which there is more than one person per room.

e. Family Relationships - The role of emotional factors as a predisposing element in family relationships is suggested by reported data which reveals that one-third of the poisoning cases are from broken families, i.e., the absence of a father, an unmarried mother, and parents divorced or separated. A penalty point is given to a census tract for each individual over age 14 reported to be either divorced or separated.

WORK SHEET A
ENVIRONMENTAL EVALUATION FROM U.S. CENSUS DATA
POTENTIAL LEAD POISONING HAZARD

CENSUS TRACT NO.	TOTAL NO. HOUSING UNITS IN CENSUS TRACT (1)	% HOUSING UNITS BUILT BEFORE 1950 (2)	% DETERIORATED HOUSING UNITS (3)	TOTAL POPULATION (4)	% CHILDREN UNDER 6 YRS (5)	POTENTIAL HAZARD SCORE FOR CENSUS TRACT (6)
	Copy Direct From Census Data	# HU X 100 / TTL HU = ___%	# HU X 100 / TTL HU = ___%	Copy Direct From Census Data	# CHILD. X 100 / TTL POPULATION = ___%	(2) + (3) + (5) = ___
P-0001	1,001	99	24	3,181	15	138

SAMPLE

WORK SHEET B
CENSUS TRACTS RANKED BY DEGREE OF POTENTIAL ENVIRONMENTAL HAZARD
DERIVED FROM U.S. CENSUS DATA

RANK	CENSUS TRACT NO.	SCORE	RANK	CENSUS TRACT NO.	SCORE	RANK	CENSUS TRACT NO.	SCORE	RANK	CENSUS TRACT NO.	SCORE

FIGURE 1

Table H-1.—OCCUPANCY AND STRUCTURAL CHARACTERISTICS OF HOUSING UNITS, BY CENSUS TRACTS: 1960

[Some data based on sample; see text. Median not shown where base is less than 50]

SUBJECT	IN CUMBERLAND COUNTY			PORTLAND					
	TOTAL	PORTLAND	BALANCE	TRACT P-0001	TRACT P-0002	TRACT P-0003	TRACT P-0003 CV	TRACT P-0004	TRACT P-0005
ALL HOUSING UNITS	41 384	26 295	15 089	• 1 001	1 209	...	...	731	829
TENURE, COLOR, AND VACANCY STATUS									
OWNER OCCUPIED	20 053	10 061	9 992	312	342	...	...	128	235
WHITE	20 008	10 019	9 989	305	337	...	...	126	230
NONWHITE	45	42	3	7	5	...	...	2	5
RENTER OCCUPIED	17 848	13 848	4 000	645	785	...	...	530	469
WHITE	17 749	13 755	3 994	640	775	...	...	505	457
NONWHITE	99	93	6	5	10	...	...	25	12
• AVAILABLE VACANT	1 633	1 328	305	34	64	...	...	62	91
FOR SALE ONLY	264	142	122	...	8	...	...	...	5
FOR RENT	1 369	1 186	183	34	56	...	...	62	86
OTHER VACANT	1 830	1 058	772	10	18	...	...	11	34
CONDITION AND PLUMBING									
SOUND	35 844	22 613	13 231	765	1 061	...	...	507	594
WITH ALL PLUMBING FACILITIES	32 828	20 208	12 620	737	1 002	...	...	456	587
LACKING ONLY HOT WATER	240	144	96	9	12	...	...	24	7
LACKING OTHER PLUMBING FACILITIES	2 776	2 261	515	19	47	...	...	27	20
DETERIORATING	4 548	3 107	1 441	• 225	133	...	...	204	144
WITH ALL PLUMBING FACILITIES	3 456	2 395	1 061	204	102	...	...	136	117
LACKING ONLY HOT WATER	181	125	56	7	13	...	...	21	11
LACKING OTHER PLUMBING FACILITIES	911	587	324	14	18	...	...	47	16
DILAPIDATED	972	575	397	• 11	15	...	...	20	91
BATHROOMS									
1	32 782	20 999	11 783	939	1 107	...	...	601	713
MORE THAN 1	4 304	2 147	2 157	21	24	...	...	...	22
SHARED OR NONE	4 264	3 135	1 129	41	78	...	...	130	94
ROOMS									
1 ROOM	1 882	1 792	90	3	4	...	...	5	...
2 ROOMS	1 842	1 630	212	12	33	...	...	46	22
3 ROOMS	3 754	2 808	946	151	86	...	...	108	46
4 ROOMS	6 618	3 902	2 716	172	171	...	...	151	155
5 ROOMS	9 354	5 833	3 521	271	395	...	...	226	282
6 ROOMS	9 354	5 398	3 956	194	279	...	...	126	183
7 ROOMS	4 602	2 567	2 035	124	145	...	...	41	79
8 ROOMS OR MORE	3 958	2 365	1 593	74	96	...	...	28	62
MEDIAN	5.2	5.0	5.5	5.1	5.3	...	...	4.7	5.2
UNITS IN STRUCTURE									
1	20 471	9 247	11 224	196	114	...	...	59	226
2	8 460	6 154	2 306	550	440	...	...	169	256
3 AND 4	5 615	4 444	1 171	221	473	...	...	266	308
5 TO 9	3 522	3 275	247	24	162	...	...	123	39
10 OR MORE	3 282	3 161	121	10	20	...	...	114	...
YEAR STRUCTURE BUILT									
1950 TO MARCH 1960	4 830	1 913	2 917	4	...	...	...	...	...
1940 TO 1949	6 249	1 610	2 639	• 93	...	...	...	...	...
1939 OR EARLIER	32 279	22 766	9 513	• 904	1 209	...	...	731	829
BASEMENT									
BASEMENT	39 134	25 302	13 832	981	1 204	...	...	696	819
CONCRETE SLAB	876	647	229	5	5	...	...	23	10
OTHER	1 340	332	1 008	15	...	...	...	12	...
HEATING EQUIPMENT									
STEAM OR HOT WATER	26 301	19 046	7 255	676	865	...	...	420	394
WARM AIR FURNACE	7 702	3 008	4 694	101	44	...	...	11	65
BUILT-IN ROOM UNITS	1 407	645	762	32	10	...	...	3	10
OTHER MEANS WITH FLUE	5 512	3 294	2 218	153	286	...	...	247	345
OTHER MEANS WITHOUT FLUE	267	199	68	39	...	...	...	28	4
NONE	169	97	72	...	4	...	...	22	11
ALL OCCUPIED UNITS	37 901	23 909	13 992	957	1 127	...	...	658	704
PERSONS									
1 PERSON	6 627	5 366	1 261	153	121	...	...	128	72
2 PERSONS	10 885	6 891	3 994	273	291	...	...	151	175
3 PERSONS	6 693	3 953	2 740	168	231	...	...	120	102
4 PERSONS	5 921	3 292	2 629	137	186	...	...	97	129
5 PERSONS	4 029	2 172	1 857	98	141	...	...	72	82
6 PERSONS OR MORE	3 746	2 235	1 511	128	157	...	...	90	144
MEDIAN:									
ALL OCCUPIED	2.7	2.5	3.1	2.8	3.2	...	...	2.9	3.5
OWNER	3.1	3.0	3.2	3.1	3.7	...	...	...	3.5
RENTER	2.4	2.2	3.0	2.9	3.4	...	...	2.9	3.6
PERSONS PER ROOM									
0.50 OR LESS	17 981	11 534	6 443	441	481	...	...	285	277
0.51 TO 0.75	8 597	5 089	3 508	235	266	...	...	145	180
0.76 TO 1.00	8 676	5 600	3 076	188	268	...	...	134	166
1.01 OR MORE	2 647	1 682	965	93	112	...	...	94	111

Census Tracts

FIGURE 2

Table P-2.--AGE, COLOR, AND MARITAL STATUS OF THE POPULATION, BY SEX, BY CENSUS TRACTS: 1960

[Median not shown where base is less than 50]

SUBJECT	IN CUMBERLAND COUNTY						PORTLAND			
	TOTAL		PORTLAND		BALANCE		TRACT P-0001		TRACT P-0002	
	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE
AGE										
TOTAL	56 568	64 087	33 417	39 149	23 151	24 938	1 521	1 660	1 942	2 075
UNDER 1 YEAR	1 289	1 311	776	774	513	537	46	38	51	48
1 YEAR	1 231	1 256	714	725	517	531	37	[illegible]	46	50
2 YEARS	1 273	1 236	716	710	557	526	30	38	45	44
3 YEARS	1 223	1 219	714	676	509	543	34	44	49	37
4 YEARS	1 173	1 181	650	680	523	501	43	20	48	44
5 YEARS	1 211	1 196	669	695	542	501	33	34	45	39
6 YEARS	1 180	1 180	697	637	483	543	30	27	49	39
7 YEARS	1 188	1 166	642	656	546	510	[illegible]	[illegible]	43	47
8 YEARS	1 182	1 126	673	634	509	492	[illegible]	[illegible]	45	47
9 YEARS	1 103	1 052	596	579	507	473	[illegible]	[illegible]	45	34
10 YEARS	1 151	1 078	656	657	495	421	[illegible]	[illegible]	46	37
11 YEARS	1 129	1 113	626	650	503	463	40	[illegible]	28	36
12 YEARS	1 191	1 187	692	660	499	527	35	1	52	40
13 YEARS	1 179	1 147	664	642	515	505	28	27	31	46
14 YEARS	895	846	510	473	385	373	28	23	41	31
15 YEARS	992	962	530	566	462	396	25	27	41	34
16 YEARS	1 074	1 026	590	601	484	425	34	31	32	39
17 YEARS	953	981	547	574	406	407	30	19	41	37
18 YEARS	648	1 014	361	719	287	295	21	20	25	32
19 YEARS	521	794	301	569	220	225	19	21	21	23
20 YEARS	502	735	314	518	188	217	18	29	25	27
21 YEARS AND OVER	34 280	41 281	20 779	25 754	13 501	15 527	864	1 072	1 093	1 264
TOTAL	56 568	64 087	33 417	39 149	23 151	24 938	1 521	1 660	1 942	2 075
UNDER 5 YEARS	6 189	6 203	3 570	3 565	2 619	2 638	190	182	239	223
5 TO 9 YEARS	5 864	5 720	3 277	3 201	2 587	2 519	156	122	227	206
10 TO 14 YEARS	5 545	5 371	3 148	3 082	2 397	2 289	164	137	198	190
15 TO 19 YEARS	4 188	4 777	2 329	3 029	1 859	1 748	129	118	160	165
20 TO 24 YEARS	2 645	3 283	1 697	2 152	948	1 131	85	135	106	133
25 TO 29 YEARS	3 018	3 353	1 824	1 962	1 194	1 391	99	98	107	112
30 TO 34 YEARS	3 472	3 863	1 971	2 195	1 501	1 668	85	106	123	119
35 TO 39 YEARS	3 798	4 203	2 111	2 362	1 687	1 841	83	95	114	130
40 TO 44 YEARS	3 611	4 090	2 039	2 422	1 572	1 668	83	97	106	130
45 TO 49 YEARS	3 534	3 975	2 064	2 434	1 470	1 541	81	108	111	127
50 TO 54 YEARS	3 302	3 758	2 013	2 381	1 289	1 377	90	94	108	116
55 TO 59 YEARS	2 894	3 443	1 800	2 156	1 094	1 287	55	87	89	90
60 TO 64 YEARS	2 595	3 167	1 597	2 051	998	1 116	55	86	74	81
65 TO 69 YEARS	2 151	2 994	1 394	1 988	757	1 006	54	65	63	80
70 TO 74 YEARS	1 715	2 368	1 201	1 635	514	733	50	43	51	71
75 TO 79 YEARS	1 096	1 752	740	1 278	356	474	30	53	39	50
80 TO 84 YEARS	605	1 051	421	751	184	300	19	24	15	31
85 YEARS AND OVER	346	716	221	505	125	211	13	10	12	21
MEDIAN AGE	31.2	34.3	32.2	35.8	29.9	32.3	26.8	31.8	26.9	30.4
WHITE	56 294	63 825	33 176	38 919	23 118	24 906	1 492	1 641	1 921	2 038
UNDER 5 YEARS	6 146	6 175	3 538	3 545	2 608	2 630	188	182	238	219
5 TO 9 YEARS	5 841	5 692	3 256	3 174	2 585	2 518	152	118	225	201
10 TO 14 YEARS	5 524	5 345	3 129	3 057	2 395	2 288	157	133	197	184
15 TO 19 YEARS	4 174	4 745	2 317	3 001	1 857	1 744	128	118	159	160
20 TO 24 YEARS	2 628	3 271	1 680	2 142	948	1 129	85	134	105	132
25 TO 29 YEARS	2 992	3 336	1 801	1 949	1 191	1 387	99	98	105	109
30 TO 34 YEARS	3 443	3 845	1 944	2 180	1 499	1 665	83	105	120	117
35 TO 39 YEARS	3 778	4 184	2 093	2 344	1 685	1 840	81	94	108	125
40 TO 44 YEARS	3 602	4 074	2 031	2 407	1 571	1 667	81	96	105	128
45 TO 49 YEARS	3 519	3 964	2 049	2 424	1 470	1 540	80	106	109	125
50 TO 54 YEARS	3 288	3 749	2 001	2 372	1 287	1 377	90	92	108	116
55 TO 59 YEARS	2 886	3 434	1 793	2 148	1 093	1 286	54	87	89	90
60 TO 64 YEARS	2 585	3 156	1 588	2 044	997	1 112	53	86	74	81
65 TO 69 YEARS	2 143	2 987	1 386	1 981	757	1 006	53	62	63	80
70 TO 74 YEARS	1 703	2 356	1 190	1 623	513	733	46	43	50	70
75 YEARS AND OVER	2 042	3 512	1 377	2 528	665	984	62	87	66	101
MEDIAN AGE	31.2	34.4	32.2	35.9	29.9	32.3	26.8	31.8	26.7	30.6
NONWHITE	274	262	241	230	33	32	29	19	21	37
UNDER 5 YEARS	43	28	32	20	11	8	2	...	1	4
5 TO 9 YEARS	23	28	21	27	2	1	4	4	2	5
10 TO 14 YEARS	21	26	19	25	2	1	7	4	1	6
15 TO 19 YEARS	14	32	12	28	2	4	1	...	1	5
20 TO 24 YEARS	17	12	14	10	3	2	...	1	1	1
25 TO 29 YEARS	26	17	23	13	3	4	...	...	2	3
30 TO 34 YEARS	29	18	27	15	2	3	2	1	3	2
35 TO 39 YEARS	20	19	18	18	2	1	2	1	6	5
40 TO 44 YEARS	9	16	8	15	1	1	2	1	1	2
45 TO 49 YEARS	15	11	15	10	...	1	1	2	2	2
50 TO 54 YEARS	14	9	12	9	2	...	...	2	...	...
55 TO 59 YEARS	8	9	7	8	1	1	1	...	...	...
60 TO 64 YEARS	10	11	9	7	1	4	2	...	...	...
65 TO 69 YEARS	8	7	8	7	...	...	1	3	...	...
70 TO 74 YEARS	12	12	11	12	1	...	4	...	1	1
75 YEARS AND OVER	5	7	5	6	...	1	...	...	...	1
MEDIAN AGE	28.7	26.5	29.9	26.9	...	...	...	...	...	...
MARITAL STATUS										
TOTAL, 14 YEARS AND OVER	39 865	47 639	23 932	29 774	15 933	17 865	1 039	1 242	1 319	1 487
SINGLE	9 395	10 614	5 986	7 326	3 409	3 288	289	300	384	367
MARRIED	27 609	28 006	15 902	16 115	11 707	11 891	669	703	838	856
SEPARATED	372	640	297	494	75	146	7	24	15	30
WIDOWED	1 769	6 940	1 211	4 792	558	2 148	57	172	48	196
DIVORCED	1 092	2 079	833	1 541	259	538	24	67	49	68
NONWHITE, 14 YEARS AND OVER	189	186	171	163	18	23	16	11	17	26
SINGLE	49	48	43	44	6	4	1	1	2	11
MARRIED	117	106	105	89	12	17	11	8	14	13
SEPARATED	10	5	9	5	1	...	1	...	2	...
WIDOWED	16	24	16	22	...	2	3	1	1	1
DIVORCED	7	8	7	8	...	...	1	1	...	1